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U. S. DEPARTMENT OF AGRICULTURE,
WEATHER BUREAU.
BULLETIN No. 10.

THE CLIMATE OF CHICAGO.

BY

HENRY A. HAZEN,
PROFESSOR OF METEOROLOGY.

Published by authority of the Secretary of Agriculture.

WASHINGTON, D. C.:
WEATHER BUREAU.
1893.

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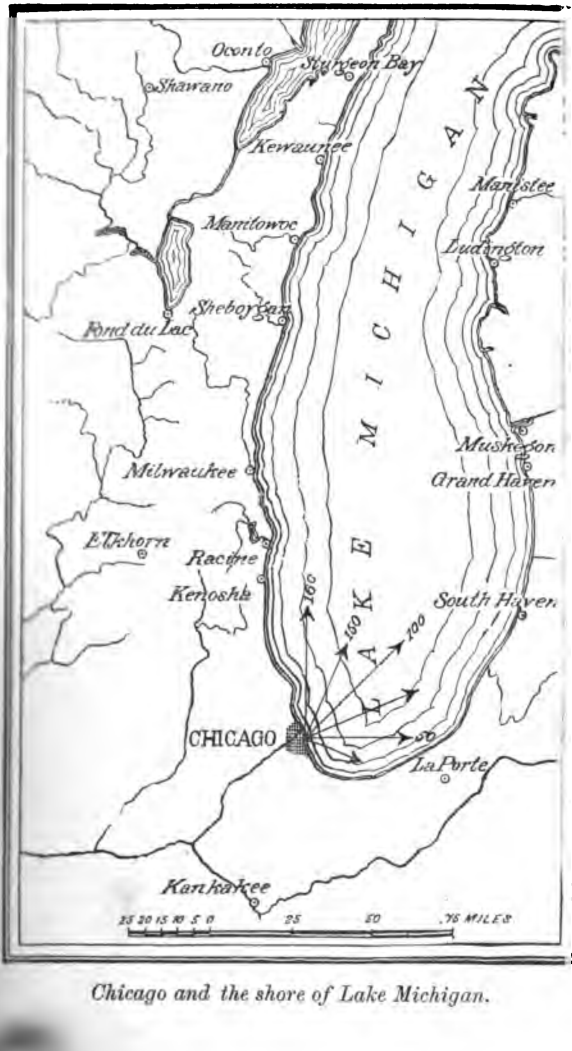

Chicago and the shore of Lake Michigan.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Weather Bureau,
Washington, D. C., July 12, 1893.

Sir: I have the honor to transmit herewith a paper entitled "The Climate of Chicago," which has been prepared by Prof. Henry A. Hazen, of this Bureau, and to recommend its publication as Weather Bureau Bulletin No. 10.

Very respectfully,

Mark W. Harrington,
Chief of Weather Bureau.

Hon. J. Sterling Morton,
Secretary of Agriculture.

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THE CLIMATE OF CHICAGO.

LOCATION OF CHICAGO.

The city of Chicago is situated on the west shore of Lake Michigan. The courthouse is in latitude 41° 53′ north, longitude 87° 37′ west, from Greenwich. The frontispiece shows the general trend of the shore of the lake. The following measurements indicate the water surface which would be traversed by different winds: north, 150 miles; north-northeast, 300 miles; northeast, 108 miles; east, 50 miles; southeast, 25 miles. The land surface about Chicago is almost a level prairie. The elevation of the lake (high water of 1848) is 582 feet above the sea. The highest land in the State, so far as measured and recorded, is at Warren in the extreme northwest, 1,005 feet. The elevations of the following towns will show the general heights within 50 miles of the city: Saint Ann, 660 feet; Kankakee, 626 feet; Geneva, 717 feet; Elgin, 713 feet; and Aurora, 648 feet. It will be seen that the general elevation of the whole land surface is not more than 100 feet above the plane of the city.

METEOROLOGIC OBSERVATIONS.

The earliest meteorologic observations that have been preserved were made at Fort Dearborn, near the lake shore, in July, 1832. This series was continued until December, 1836, when there is a gap up to December, 1856, excepting a few observations at the Mechanics' Institute, in 1844. From January 1, 1858, to October, 1859, no records are on file, but since November, 1859, a continuous series of observations has been maintained down to the present time, with the exception of 14 days in October, 1871, which were lost in the great fire of October 8 and 9. These remarks apply to observations of temperature. For rainfall the records are not so complete.

Previous to November, 1870, when the Army Signal Service began observations, the following persons took observations: S. Meacham, S. Brooks, J. G. Langguth, W. S. Kauffman, C. E. Brinsmade, A. M. Byrne, G. D. Hiscox, and others. There has been no fixed place for these records, some of them have been at the University and others at various places in the city. All records of this description in the immediate city have been badly broken by the fire.

WEATHER SERVICE RECORDS.

On October 15, 1870, the U. S. Army Signal Service station was established at No. 162 E. Washington street, and observations have been maintained continuously since that time, except for 14 days in October, 1871. The following table gives the location of each office, with date of establishment and height of each instrument. The records before October, 1871, are somewhat uncertain, as the complete obliteration of many records and the buildings themselves has prevented a recovery of measurements. It will be noted that there has been a rather steady increase in the heights of all the instruments down to February, 1890, and this will make it quite difficult to obtain absolute comparisons between the records at the different offices, except those of the barometer, clouds, fog, storms, etc.

TABLE I.—*Position of each Signal Office in Chicago, with elevation of each instrument.*

Established.	Office.	Room.	Barometer above sea.	Thermometer above ground.	Rain gauge above ground.	Anemometer above ground.	Wind vane above ground.
			Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Oct. 15, 1870	162 E. Washington st	21	651	57	?	?	?
[illegible]	162 E. Washington st	52	651	57	67?	85?	85?
[illegible]	10 W. Randolph st.	2	633	32	43	72	72
[illegible]	80 S. Market, Central Block	....	667	74	97	108	113
[illegible]	SE. cor. Madison & La Salle sts.	78	661	70	93	103	108
[illegible]	SW. cor. Clark & Washington sts.	1028	715	146	132	153	155
[illegible]	Auditorium Building	....	824	241	238	272	272

TABLE II.—*Names of the observers in charge of the Chicago station from establishment to present time.*

Name.	From—	To—
[illegible] Mackintosh	October 10, 1870 (about).	July 17, 1872.
[illegible] Mosher	July 17, 1872	January 2, 1873.
[illegible]	January 2, 1873	May 1, 1876.
[illegible]	May 1, 1876	November 6, 1877.
[illegible]	November 6, 1877	December 21, 1877.
[illegible]	December 21, 1877	January 23, 1878.
[illegible]	January 23, 1878	January 9, 1880.
[illegible]	January 9, 1880	March 8, 1883.
[illegible]	March 8, 1883	June 26, 1883.
[illegible]	June 26, 1883	March 18, 1884.
[illegible]	March 18, 1884	July 25, 1885.
[illegible]	July 25, 1885	December 1, 1887.
[illegible]	December 1, 1887	In charge at present.

INFLUENCE OF THE LAKE.

[illegible] studying the climate of Chicago, the greatest interest at once [illegible] on the lake and the influence of its waters upon the tem[illegible] rainfall, winds, clouds, etc. While it is true that the [illegible] tures of the climate are dependent upon atmospheric [illegible] influences taking their rise to the westward and north[illegible] the city, yet these are often markedly changed by the lake and the conditions induced by its temperature and moisture. These influences may be classed under two heads:

1st. The influence of the moisture evaporated from the lake and the general or permanent influence of the presence of the lake upon temperature, etc.

2d. The effect of winds coming from the lake or blowing over the lake.

TEMPERATURE OF THE LAKE.

Water temperatures have been taken at the crib since 1874, and these form a most valuable series. Temperatures were also taken at a depth of 25 feet by the city authorities, but it was soon discovered that there was a most extraordinary uniformity between the surface temperature and that at a depth of 25 feet, the difference seldom being one degree. On inquiry it was learned that the temperatures at 25 feet were made in the well of the waterworks, and could not be used for determining the actual temperature in the lake at that depth. This would be a most interesting fact to determine, that is, the comparative quickness of change in temperature in the lake at the surface and at a depth of 25 feet, and, if possible, 50 or more feet. It would be a simple matter to get this temperature, and it is to be hoped that the authorities will take steps to make the measurements.

The Weather Service observer also took a record at the shore, but this was discontinued in the cold season, while the crib observations are taken through the year. A comparison of a few of the complete months at both places has shown that in the winter, spring, and summer the shore temperature has a tendency to run slightly higher than the crib, but in the fall the crib is frequently the higher. This shows the influence of the land surface with a rising temperature.

Table III gives the monthly temperature of the water at the crib, and of the air at the Weather Service station. It was noticed that sometimes in the winter the mean monthly temperature of the water was below 32°, which is a little doubtful result. These figures have been unchanged, as they can have but a very slight effect upon the final means. Examining the means for the 17 years, we see that, on the average, the water and air have the same temperature in March and September. In January the water is 8.9° higher than the air, and in June it is 9.1° lower than the air. These figures are of great interest, which will be still further brought out in studying the influence of the wind.

TABLE III.—*Water and air temperature, Chicago.*

Month.	1874.			1875.			1876.			1877.			1878.			1879.			1880.			1881.		
	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	32.0	32.0	28.9	32.0	33.9	17.9	35.0	33.3	33.0	33.0	32	22	33	33	31	32	32	21	36	33	40	32	33	20
February	32.0	34.3	31.4	32.0	33.0	14.7	36.2	32.7	31.8	34.6	34	36	32	32	36	32	34	27	35	33	35	32	34	25
March	32.0	35.5	36.5	32.0	32.4	31.8	36.5	33.5	33.9	33.7	33	29	42	38	44	37	35	39	34	35	38	32	35	32
April	40.2	39.7	38.6	38.3	37.4	42.5	45.8	39.2	46.5	44.6	40	45	48	45	52	44	40	47	48	43	48	32?	36	42
May	52.7	50.2	59.3	48.9	47.1	55.5	54.8	48.6	59.0	53.8	48	57	55	53	56	53	51	58	68	52	64	57	50	61
June	62.8	63.5	70.5	60.7	55.0	63.1	59.2	54.0	67.5	58.3	56	66	63	60	65	58?	56	65	77	57	70	62	56	63
July	69.7	68.5	74.8	66.4	63.9	68.8	66.5	64.5	73.5	69.6	64	73	71	69	75	72	66	73	68	66	72	72	71	73
August	70.6	71.0	71.8	66.1	65.5	68.4	70.0	66.5	73.5	68.8	68	71	73	72	74	71	68	73	73	68	72	75	74	75
September	67.9	70.3	66.4	60.4	60.4	61.0	65.0	63.7	61.1	65.9	66	66	67	64	66	64	63	61	67	65	62	65	64	70
October	55.9	58.1	53.0	51.7	50.3	47.5	52.0	50.5	48.8	55.4	58	55	54	54	52	60	56	60	54	50	51	57	55	56
November	42.3	47.8	40.3	39.4	41.1	37.0	44.2	43.5	39.3	42.7	44	40	42	42	43	41	43	42	42	40	31	43	44	40
December	31.9	34.7	33.5	34.8	33.7	36.8	33.0	32.5	20.0	38.0	37	43	33	34	24	33	35	30	33	32	23	37	36	37
Mean	49.2	50.5	50.4	46.9	46.1	45.4	49.9	46.9	49.0	49.9	48.3	50	51.1	49.7	51	49.8	48.2	50	52.9	47.8	51	49.6	49.0	49

Month.	1882.			1883.			1884.			1885.			1886.			1887.		1888.		1889.		1890.		Mean.	
	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Wharf.	Crib.	Air.	Crib.	Air.	Crib.	Air.	Crib.	Air.	Crib.	Air.	Crib.	Air.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	33	32	28	32	30	16	32	36	19	32	36	18	32	32	21	32	17	32	15	32	29	34	31	32.9	24.0
February	37	33	38	32	30	23	32	35	28	32	36	17	32	33	28	31	27	32	23	32	20	33	32	33.1	27.8
March	38	35	38	32	32	31	32	34	34	32	37	30	32	33	36	32	32	32	30	36	38	33	30	34.3	34.3
April	46	42	46	32	41	46	43	40	44	44	43	45	45	40	49	38	47	40	45	43	47	41	46	40.6	45.7
May	......	46	52	......	52	52	53	49	57	54	49	53	56	51	57	51	59	47	53	52	57	49	53	49.1	56.6
June	......	54	64	59	57	64	61	56	65	60	56	65	64	57	66	59	67	56	67	55	62	56	70	56.8	65.9
July	66	62	69	62	62	71	68	64	69	64	61	73	70	66	71	65	76	65	73	66	70	68	72	65.3	72.2
August	72	69	71	68	67	68	67	62	69	69	65	68	71	68	72	69	70	66	69	64	71	66	68	67.6	70.9
September	69	66	65	63	65	61	64	60	69	65	62	64	66	63	66	64	62	64	60	57	63	62	60	63.6	63.7
October	60	60	56	54	56	52	56	56	56	54	55	51	56	55	57	53	47	50	49	51	49	56	51	54.4	52.4
November	46	46	42	42	45	42	43	45	40	......	44	42	40	44	38	40	38	45	42	43	39	43	42	43.6	39.9
December	33	32	26	33	39	30	33	37	28	......	33	31	32	32	25	33	28	35	32	38	41	32	31	34.6	30.3
Mean	......	48.1	50	......	48.0	46	48.7	47.8	48	......	48.1	46	49.7	47.8	49	47.3	48	47.0	47	47.4	49	47.8	49	48.0	48.6

The minimum of both air and water comes in January. The maximum of the air is in July, 72.2°, but that of the water is in August, 67.6°. An examination of the annual means seems to show a gradual lowering of the temperature in the later years, but the same is noted in the air temperature. It would be of some interest to discuss the question whether the mean temperature of the lake from year to year would not be a better criterion than the air temperature for determining a secular variation. For this purpose, careful observations at a depth of 50 feet would be better than those at the surface. The annual amplitude of the lake temperature since 1877 has been from 49.7° to 47.0°, and of air temperature it has been from 51° to 46°, or nearly double that of the lake surface.

LAKE TEMPERATURES AT GRAND HAVEN AND MILWAUKEE.

For purposes of comparison, similar temperatures of water and air at Grand Haven and Milwaukee are given in Table IV.

TABLE IV.—*Water and air temperature at Grand Haven, Mich.*

Month.	1876.		1877.		1878.		1879.		1880.		1881.		1882.		1883.		1884.		1885.		1886.		Mean.	
	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	34	32	32	24	34	31	32	25	32	37	32	20	32	28	32	20	32	21	32	21	32	20	32.2	25.4
February	32	29	33	33	33	34	32	23	33	32	32	24	31	36	32	24	32	25	32	15	32	23	32.2	27.1
March	34	30	33	28	42	43	36	35	39	34	33	31	35	35	32	27	36	32	32	23	33	30	35.0	31.6
April	47	45	50	46	52	52	45	44	49	44	50	40	43	44	48	44	47	44	46	43	52	47	48.1	44.8
May	60	55	61	58	54	53	62	58	66	61	68	62	52	52	58	51	61	55	59	53	63	52	60.4	55.5
June	72	66	71	64	67	63	71	64	72	67	71	62	65	63	68	62	74	68	71	60	72	61	70.4	63.6
July	78	71	76	69	77	73	80	72	77	70	77	71	70	66	73	67	75	67	76	67	73	66	75.6	69.0
August	77	70	74	69	76	70	74	68	76	68	76	71	71	69	71	65	74	66	71	61	74	67	74.0	67.6
September	65	58	69	64	69	63	61	58	65	60	71	67	65	62	65	57	70	65	65	60	67	62	66.5	61.5
October	48	47	57	53	55	51	62	58	52	49	58	52	55	55	53	48	58	54	53	46	56	52	55.2	51.4
November	43	39	41	39	41	41	43	39	39	32	41	40	39	40	41	41	41	38	41	39	39	35	40.8	38.5
December	33	22	38	42	34	28	33	29	33	25	35	37	30	28	33	31	35	28	34	28	33	22	33.7	29.1
Mean	52	47	53	49.3	53	50.2	53	47.8	53	48.2	54	48.1	49.0	48.2	50.5	44.7	52.9	47	51	43	52.2	44.8	52.0	47.1

Water and air temperature at Milwaukee, Wis.

Month.	1874.		1875.		1876.		1877.		1878.		1879.		1880.		1881.		1882.		1883.		1884.		1885.		Mean.	
	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.	Water.	Air.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	32	23	33	10	33	26	32	15	34	26	32	22	33	35	32	16	32	25	32	13	32	14	32	10	32.4	19.6
February	32	26	32	8	32	25	33	32	34	32	32	23	34	28	32	23	32	36	32	20	32	22	32	10	32.4	22.4
March	35	31	35	26	32	28	33	23	39	40	35	36	35	32	35	30	36	35	32	29	32	30	35	24	34.5	30.3
April	42*	36	39	38	41	42	41	41	48	50	42	44	44*	44	42	40	42	43	42	43	41	41	42	40	43.1	41.8
May	51	56	50	52	50*	52	53	53	50	53	48*	54	51	61	53	58	48	49	46	50	49	54	47	50	49.7	53.5
June	59	66	57	60	55	63	63	61	58	62	53	62	53	67	55	60	54	61	55	62	56	60	55	60	56.1	62.0
July	63	71	62	66	61	70	60	69	70	73	62	72	58	69	62	71	58	66	59	68	61	66	58	68	61.2	69.1
August	68	68	61	65	67	70	67	69	72	71	68	69	70	69	70	71	68	68	64	66	60	66	62	63	66.4	67.9
September	63	65	58	57	62	58	64	64	62	63	61	58	63	60	59	64	67	63	60	57	66	64	60	60	61.2	61.1
October	50	50	50	44	50	44	52	50	44	49	51	55	48	48	52	52	56	56	52	49	52	53	54	46	50.9	49.7
November	40	35	40	31	42	35	45	35	38	41	40	36	38	27	42	37	43	40	40	38	42	35	44	38	41.2	35.7
December	32	25	33	32	33	14	39	37	32	22	33	23	33	19	36	35	33	24	32	26	33	23	33	28	33.5	25.7
Mean	47.3	46	45.8	41	46.5	44	48.5	46	48.4	48	46.4	46	46.7	47	47.5	46.4	47.5	47	45.5	43	45.5	44	46.2	41	46.9	44.9

*Interpolated.

The result at Grand Haven is remarkable, for the water temperature appears to be *higher* than that of the air during every month of the year. It seems difficult to account satisfactorily for this anomalous result. It is possible that there is some local effect that produces it. It may be that the water was quite shallow or somewhat embayed so that the sun's heat produced a cumulative effect and the freer waters of the lake did not reach the point where the temperature was taken. I have thought that possibly the surface water was driven on shore by the prevailing westerly winds, and the temperature in this case would be somewhat raised, especially in the summer. It has also been suggested that the current in the lake is from south to north on the east side; this would carry up warm water from the south.

At Milwaukee the correspondence between the water and air occurs in the early part of May instead of March, as at Chicago; in the fall the agreement is in September at both stations.

INFLUENCE OF THE LAKE ON THE AIR TEMPERATURE.

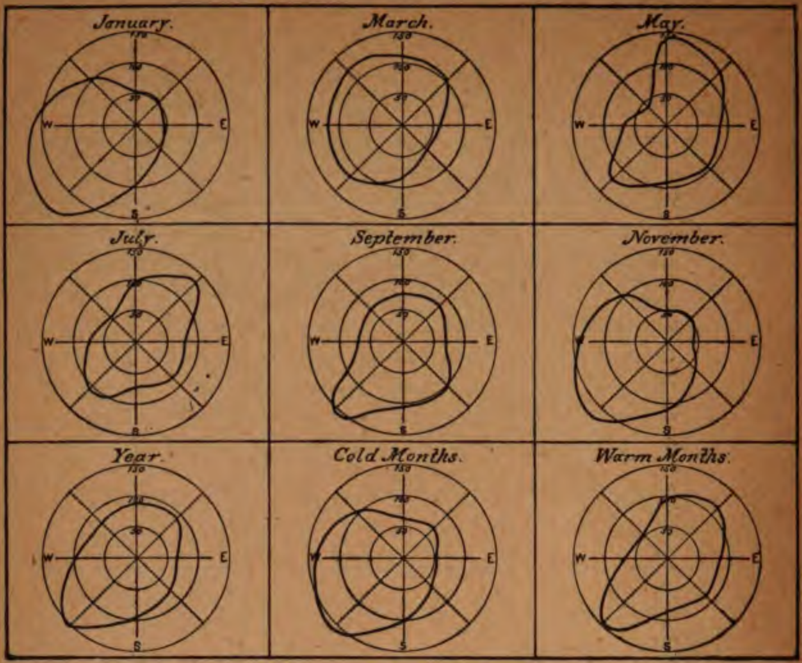
In studying the relation of the lake temperature to that of the air, we may arrange all the temperatures recorded during the prevalence of each wind and then ascertain whether the winds from the lake have a modifying influence, or we way compare these temperatures at Chicago directly with those at any other station not affected by the lake.

PREVAILING WINDS.

Table V gives the number of times the wind was observed blowing from each direction during 18 years. Most of this table is made up from observations three times each day. Fig. 1 presents a graphical arrangement of this table, or the wind rose for every other month, the year, the cold, and warm months. We see that for the year there is a maximum of winds from the southwest, and a secondary maximum from the northeast. During the cold months there is a marked preponderance of land winds while in the warm months there is a slight preponderance of lake winds.

TABLE V.—*Wind direction for eighteen years.*

	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.
January	99	98	101	112	208	390	334	207	30
February	97	161	105	148	217	278	253	164	19
March	216	201	130	120	175	241	229	244	25
April	271	239	179	156	144	234	145	129	32
May	272	250	181	192	192	252	132	79	31
June	229	212	173	160	167	297	149	103	40
July	190	272	164	166	142	315	149	115	37
August	179	301	190	189	177	260	103	104	47
September	147	164	139	206	212	314	141	143	34
October	142	152	123	155	263	317	170	197	31
November	99	100	84	135	224	347	288	207	16
December	93	78	73	144	227	389	298	228	20
Year	169	186	137	157	196	303	199	160	..
Cold months	126	135	102	131	207	325	278	211	..
Medium months	196	185	142	160	206	288	184	153	..
Warm months	186	237	167	180	175	297	136	116	..


January. March. May.

July. September. November.

Year. Cold Months. Warm Months.

FIG. 1.—*Wind rose for six months, the year, cold and warm months.*

At first sight it might appear that this difference in the prevailing winds would have a disturbing effect upon the determination of their effect upon the various meteorologic elements—temperature, rainfall, etc.,—and this would be the case if we simply summed up the temperature, rainfall, etc., from each wind, as some have done, but this source of error entirely disappears if we determine the relative values of those elements with each wind. For example, suppose we have 300 southwest winds and rain occurring during 60 of them, and 100 east winds with rains occurring during 50 of them, we could not say that rain was more frequent with a southwest than with an east wind, only 20 per cent. of the southwest winds have rain, while 2½ times as many east winds, or 50 per cent., have rain. The only source of error that this difference in the number of winds will introduce will be in the scarcity of observations of temperature, etc., with some of the directions, but this may be eliminated by taking a larger number of months.

Table VI gives the mean temperature by months for each wind direction, from 1875–1877, inclusive, and also the mean for the year, the cold, medium, and warm months. Fig. 2 is a graphical presenta- [illegible] his table (every other month is omitted). In the colder [illegible] e see a most marked influence from the lake, an east wind [illegible] emperature almost 13° higher than a northwest wind. In [illegible] n temperature months there is little or no influence, as was to be expected, since this is the transition period when the air and water temperatures are nearly the same. At first it appears a little singular that the lake wind does not show a greater cooling of the air during the warm months, in fact, the effect appears almost inappreciable. We must remember that in summer the wind velocity is largely diminished, that is, about 30 per cent. less than in winter, but the more potent influence would seem to be the effect of the earth's heat upon the wind before it reaches the thermometer.

TABLE VI.—*Temperature and wind from* 1875 *to* 1877.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	°	°	°	°	°	°	°	°
January	25.5	29.0	30.0	30.5	31.0	26.6	15.7	16.1
February	31.4	30.5	34.0	33.0	35.2	24.1	22.1	19.9
March	28.6	25.6	34.3	42.9	44.7	29.2	30.2	23.1
April	41.8	43.3	44.1	48.2	55.9	45.8	46.6	42.4
May	47.3	47.1	54.0	59.2	66.9	65.1	62.9	55.0
June	58.3	59.5	63.6	66.5	71.6	69.3	68.0	66.1
July	66.1	69.2	69.6	72.0	78.3	78.4	74.2	70.8
August	66.8	67.8	71.3	71.4	75.2	73.2	71.7	69.8
September	59.0	63.9	63.3	66.6	66.9	65.3	57.0	53.5
October	47.6	54.3	51.5	53.0	45.1	52.3	46.3	44.3
November	40.8	41.5	43.7	41.8	42.5	40.3	32.6	32.3
December	37.2	36.6	37.7	38.3	38.2	35.1	25.1	26.2
Year	45.9	47.4	49.8	51.9	55.1	50.4	46.0	43.3
Cold months	30.7	30.4	34.0	36.4	37.3	28.8	23.3	21.3
Medium months	44.4	46.6	48.3	50.6	55.1	50.9	47.1	43.5
Hot months	62.6	65.1	67.0	69.1	73.0	72.1	67.7	65.1

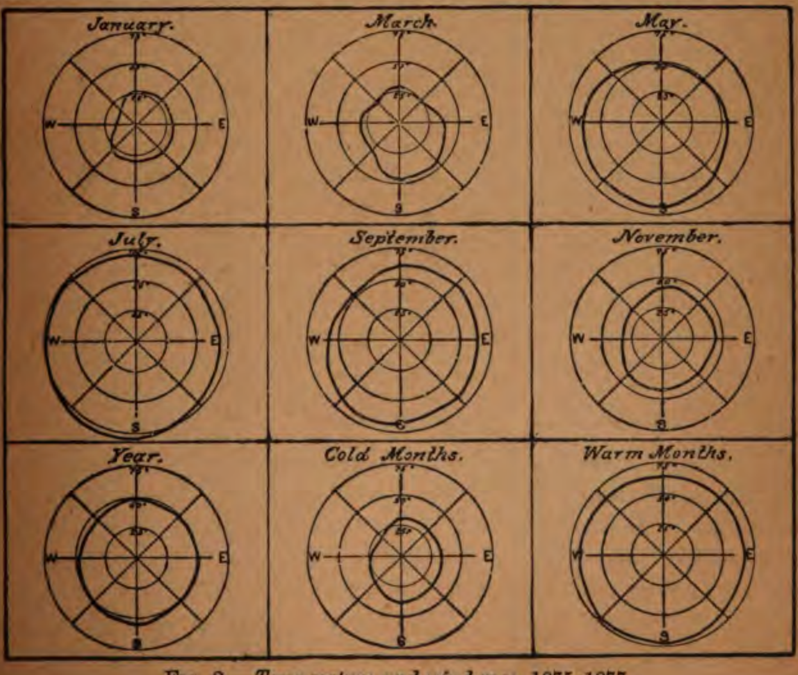


FIG. 2.—*Temperature and wind rose*, 1875–1877.

In addition to this, the problem is much complicated by the cloudiness, the land and sea breezes, etc. We shall see that there is a de-

[illegible] during the afternoon in summer while [illegible] during the night. In the summer also only [illegible] of the sky is clouded, and the clearest skies are [illegible] the result is that a land wind is cooled off a great [illegible] in the clear sky and this tends to equalize [illegible] lake and land winds. It is not so much [illegible] effect during the hot season as that the land [illegible] at the time when its effect is greatest upon the [illegible] We shall see a little later that both these causes tend [illegible] temperature down, and the diurnal range is [illegible] any station in this country east of the Rocky [illegible] the highest temperatures experienced there is [illegible] that a shift of wind to the lake cools the air most [illegible]

[illegible] of so great importance that it has been deemed [illegible] second computation during the period 1884–1886. [illegible] these results. Here again we have the same [illegible] that we had before. A marked effect in the cold [illegible] any in the medium and warm months.

[illegible] VII.—*Temperature and wind from* 1884 *to* 1886.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	°	°	°	°	°	°	°	°
[illegible]	[illegible]	27.0	27.9	34.2	27.2	19.0	11.3	18.3
[illegible]	[illegible]	27.2	30.3	36.0	30.6	21.3	16.7	22.3
[illegible]	[illegible]	26.6	39.3	45.0	42.9	35.2	31.5	30.1
[illegible]	[illegible]	42.0	47.6	55.9	61.2	52.5	42.7	38.7
[illegible]	[illegible]	53.7	55.7	60.6	63.8	60.6	53.3	51.2
[illegible]	[illegible]	61.7	64.5	68.1	74.6	73.3	74.0	60.2
[illegible]	[illegible]	68.8	70.7	75.3	75.5	76.7	73.6	69.7
[illegible]	[illegible]	68.7	67.1	72.0	75.4	73.7	69.5	65.5
[illegible]	[illegible]	68.8	66.1	64.9	72.6	69.1	64.3	55.5
[illegible]	[illegible]	53.0	58.7	59.3	58.6	58.5	48.7	49.5
[illegible]	[illegible]	38.1	42.9	44.8	46.4	41.1	34.6	33.1
[illegible]	[illegible]	33.6	30.3	34.6	38.2	26.2	22.1	18.3
[illegible]	[illegible]	47.4	50.1	54.2	55.6	50.6	45.2	42.7
[illegible]	[illegible]	28.6	31.9	37.4	34.7	25.4	20.4	22.2
[illegible]	[illegible]	50.5	53.8	56.2	59.7	55.3	47.6	44.2
[illegible]	[illegible]	63.2	64.5	69.0	72.3	71.3	67.6	61.7

[illegible] BETWEEN CHICAGO AND INDIANAPOLIS.

[illegible] method of determining the lake influence would be to [illegible] some station off from the lake; for this purpose [illegible] has been chosen, as, on the whole, the best at which we [illegible] observations. The years 1882–1886 were taken and the [illegible] May, and July as typical months. Here the lake [illegible] very plainly. In Fig. 3 we see that in January [illegible] for Chicago goes beyond the dotted curve for [illegible] winds while it is inside for land winds. In [illegible] other hand, it is wholly within the dotted curve. [illegible] a part of this effect is probably due to the more southerly latitude of Indianapolis. Also it appears that May is hardly a medium month in a comparison between air and water temperatures, for the latter is 7.5° below the air in May, so that a strict comparison between May and medium months can not be instituted. In fact, on turning to Fig. 2, we see that the May wind rose shows a marked influence of the lake wind in cooling the air, and this serves to corroborate the present result in Fig. 3 for May.

TABLE VIII.—*Temperature and wind from* 1882 *to* 1886.

CHICAGO.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	°	°	°	°	°	°	°	°
January	25.8	25.9	27.0	30.6	28.4	20.5	14.2	16.7
May	47.8	49.8	53.1	58.5	63.4	60.5	53.4	50.1
July	64.7	67.6	70.	72.7	74.7	75.8	71.8	68.7
				INDIANAPOLIS.				
January	21.5	25.0	25.0	31.7	30.1	26.5	16.5	21.4
May	55.1	58.6	59.6	62.9	67.7	65.9	59.1	56.9
July	70.6	71.4	75.1	74.9	76.5	77.2	75.4	72.3

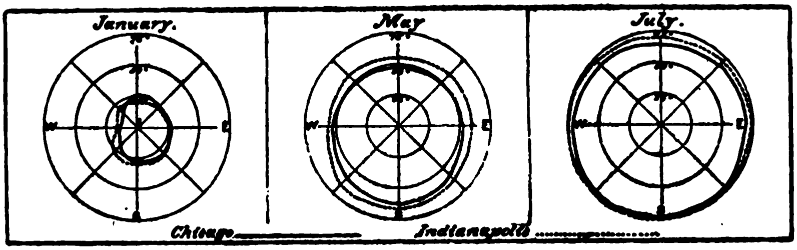


FIG. 3.—*Temperature and wind rose, Chicago and Indianapolis*, 1882–1886.

In order to fully check and also to extend these comparisons, I have made a similar determination for another office in Chicago, and

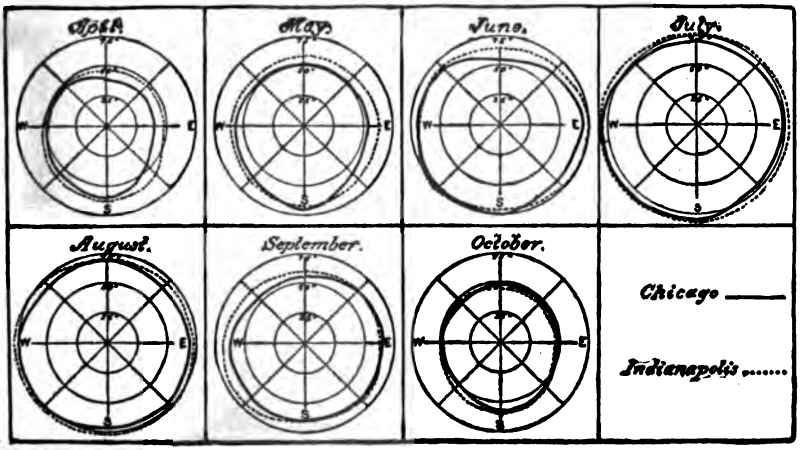


FIG. 4.—*Temperature and wind rose, Chicago and Indianapolis*, 1887–1889.

the period 1887–1889. Table IX shows these results, and the corresponding wind roses will be found in Fig. 4. We see the same effects for May and July as before, and in October the lake influence begins to make itself felt in slightly warming the air.

TABLE IX.—*Temperature and wind from* 1887 *to* 1889.

CHICAGO.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	°	°	°	°	°	°	°	°
April	38.4	40.1	41.2	47.6	60.5	55.3	48.0	47.2
May	50.0	52.1	54.2	57.2	70.0	60.7	56.8	51.3
June	54.3	61.4	69.3	67.2	75.2	72.8	68.8	67.4
July	69.6	69.7	73.9	71.9	79.1	80.0	79.7	75.0
August	69.1	66.1	69.3	71.4	72.4	75.3	73.2	66.7
September	56.5	61.1	64.5	65.7	64.7	63.3	61.7	53.8
October	48.1	47.7	50.1	52.8	57.4	49.6	48.8	45.6

INDIANAPOLIS.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
April	46	47	47	55	61	60	52	48
May	59	68	64	65	69	66	61	57
June	65	68	75	74	72	75	70	69
July	76	77	79	80	82	82	81	78
August	69	71	73	76	76	78	78	73
September	60	64	63	68	65	71	69	61
October	44	40	47	54	59	56	50	48

GENERAL INFLUENCE OF THE LAKE UPON PRECIPITATION.

The question of a general or more or less permanent effect of the lake on rainfall is not now considered, this would demand a special investigation at a large number of stations about Chicago. It would appear, however, that the Chicago snow and rain fall exceeds in winter that of nearly every Weather Station anywhere near it. In the hot months stations in the Mississippi Valley show a slightly greater rainfall. The Chicago precipitation exceeds that of Milwaukee during nearly every month. It should be borne in mind that this question of the permanent influence of the lake is very much complicated by the effect of the winds as they blow off the lake. This question can be settled quite readily in the same way it was done for temperature.

INFLUENCE OF LAKE WINDS ON PRECIPITATION.

I have determined the proportional tendency of rain with each wind for each month in the year, as given in Table X. Fig. 5 exhibits every other month of this table in graphic form. It is easy to see what a mark [illegible] the lake winds have upon winter precipitation. [illegible] and warm months, however, this influence [illegible] it is, so far as the winds are concerned, there is almos [illegible] ncy of rain with land winds as with those from [illegible] that the lake winds will have more moisture [illegible] the land. The cause of the less precipitation in the warm months is not far to seek. At the time of the lake breeze, which is relatively cool, the air above the land surface is slightly warmer and the tendency is to diminish the relative humidity of the lake wind, so that, even if the lake breeze were saturated, that condition would be very quickly changed to one of more or less dryness, and, from the very coolness of the air, there would be less chance for rainfall. This is a very important principle to be borne in mind in forecasting precipitation with a lake wind. If this wind is warm and blows upon land which has a lower temperature, there will be a tendency to precipitation; but if it is relatively cool, the heat of the land will tend to dissipate the moisture. This principle will serve to explain the rather singular diminution in the amount of clouds at Chicago during the warm months.

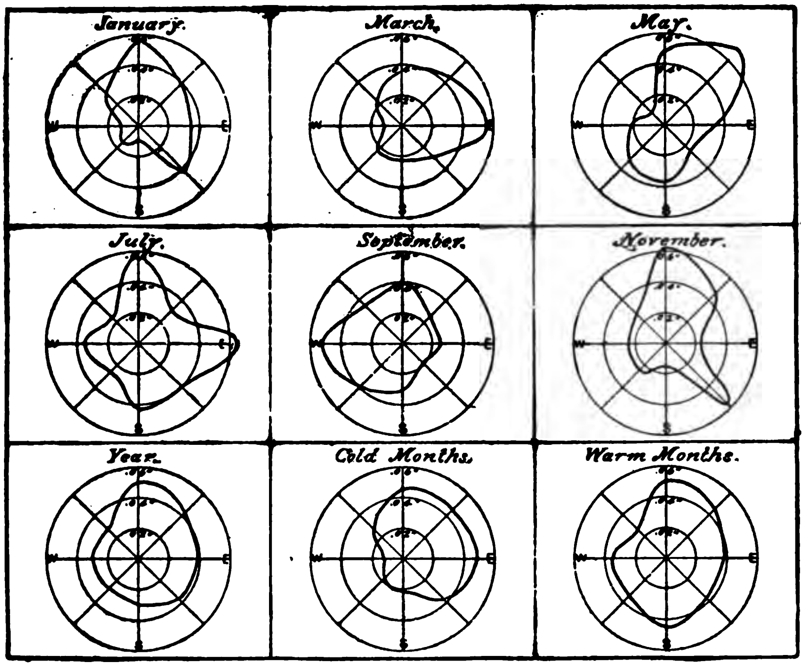


FIG. 5.—*Relative tendency of rain with each wind.*

TABLE X.—*Relative tendency of rain with each wind, Chicago.*

Months.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
Cold.								
January	.056	.039	.034	.038	.008	.014	.010	.035
February	.049	.044	.047	.023	.026	.017	.020	.034
March	.037	.045	.056	.030	.022	.022	.011	.022
October	.089	.045	.033	.040	.024	.026	.051	.042
November	.062	.047	.022	.056	.015	.024	.024	.027
December	.038	.052	.058	.057	.024	.014	.008	.01
Mean	.055	.045	.042	.041	.020	.020	.021	.

TABLE X.—*Relative tendency of rain with each wind, Chicago*—Continued.

Month.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
Storm.								
April	.032	.044	.039	.021	.020	.035	.041	.028
May	.046	.069	.034	.025	.037	.032	.019	.010
June	.047	.041	.039	.040	.063	.042	.041	.040
July	.057	.031	.065	.040	.042	.027	.035	.022
August	.049	.035	.014	.041	.036	.035	.045	.027
September	.038	.025	.025	.019	.032	.038	.052	.034
Mean	.045	.041	.036	.031	.038	.035	.039	.027
Year	.050	.043	.039	.036	.029	.027	.030	.028
Cold months	.045	.045	.049	.037	.020	.017	.012	.027
Warm months	.055	.040	.030	.034	.023	.031	.042	.033
[illegible] months	.050	.044	.038	.037	.045	.034	.035	.025

HEAVINESS OF PRECIPITATION WITH EACH WIND.

The question arises: Are the lake winds likely to give a heavier fall of rain during a storm than the land winds? Table XI exhibits precipitation by months according to the amount of rain falling at any observation. It will be seen that rains up to 1.00 inch show very slight influence from the wind direction. Above 1.00 inch, however, there seems to be a tendency for the heavier rains to come with the lake winds.

TABLE XI.—*Rain with different winds, Chicago.*

Month.	0 to .25 inch.								.26 to .50 inch.							
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
[illegible]	[illegible]	.04	.07	.09	.06	.04	.04	.04	.17	.18	.17	.17	.16	.20	.14	.23
[illegible]	[illegible]	.05	.05	.05	.04	.05	.05	.04	.18	.17	.20	.21	.14	.16	.14	.14
[illegible]	[illegible]	.05	.07	.04	.05	.05	.04	.03	.16	.16	.22	.20	.17	.17	.14	.21
[illegible]	[illegible]	.06	.05	.05	.06	.06	.06	.03	.18	.18	.20	.14	.19	.17	.19	.17
[illegible]	[illegible]	.05	.05	.05	.05	.05	.05	.06	.19	.18	.16	.17	.20	.19	.14	.15
[illegible]	[illegible]	.04	.05	.04	.06	.05	.05	.06	.17	.18	.16	.20	.19	.20	.22	.15
[illegible]	[illegible]	.04	.04	.05	.04	.05	.03	.05	.19	.19	.17	.16	.21	.18	.....	.18
[illegible]	[illegible]	.04	.03	.05	.06	.04	.04	.05	.19	.19	.....	.17	.19	.18	.....	.21
[illegible]	[illegible]	.05	.05	.05	.04	.05	.04	.04	.....	.24	.....	.24	.21	.20	.18	.20
[illegible]	[illegible]	.06	.03	.07	.06	.05	.03	.04	.19	.21	.20	.17	.17	.16	.18	.21
[illegible]	[illegible]	.06	.07	.05	.05	.05	.03	.04	.20	.17	.....	.18	.16	.17	.21	.20
[illegible]	[illegible]	.05	.05	.06	.04	.03	.02	.03	.17	.16	.19	.19	.18	.19	.16	.16
[illegible]	[illegible]	.05	.05	.05	.05	.05	.04	.04	.18	.18	.19	.18	.18	.18	.16	.18

Month.	.50 to 1.00 inch.								Above 1.00 inch.							
	N.	NE.	E.	SE.	S.	SW.	W.	NW.	N.	NE.	E.	SE.	S.	SW.	W.	NW.
[illegible]	.....	.27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.65	.....	.....	.65
[illegible]	.....	.30	.....	.....	.30	.....	.29	.....	.....	.....	.68	.....	.68	.....	.....	.....
[illegible]	[illegible]	.38	.46	.37	.37	.31	.....	.37	.59	.59	.69	.....	.....	.....	.....	.....
[illegible]	[illegible]	.33	.44	.28	.29	.35	.36	.39	.....	.....	.60	.....	.....	.....	.....	.....
[illegible]	[illegible]	.33	.27	.43	.43	.30	.33	.28	.....	1.13	.....	.....	.63	.70	.....	1.17
[illegible]	[illegible]	.30	.35	.41	.41	.34	.39	.31	.....	.69	.....	.69	.63	.....	.....	.69
[illegible]	[illegible]	[illegible]	.40	.34	.37	.34	.42	.....	.72	.77	1.49	.80	.59	.98	.....	.....
[illegible]	[illegible]	[illegible]	.....	.40	.41	.39	.....	.39	.....	.67	.....	.61	.76	.78	.56	.....
[illegible]	[illegible]	[illegible]	.31	.36	.45	.32	.33	.....	1.13	1.01	.50	.79	.74	.52	.57	.61
[illegible]	[illegible]	[illegible]	.40	.32	.37	.35	.25	.42	.84	.83	.....	.61	.68	.61	.69	.....
[illegible]	[illegible]	[illegible]	.....	.31	.30	.31	.....	.32	.....	.52	.52	.....	.55	.....	.55	.....
[illegible]	[illegible]	[illegible]	[illegible]	.33	.43	.40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
[illegible]	[illegible]	[illegible]	[illegible]	.36	.38	.34	.34	.35	.82	.78	.75	.70	.66	.72	.59	.78

INFLUENCE OF THE LAKE UPON DEW-POINT AND RELATIVE HUMIDITY.

The dew-point and relative humidity for 7 a. m. and 3 p. m. during January, May, and July of the years 1882–1886 at Chicago and Indianapolis were computed, and are given in Table XII and shown graphically in Fig. 6. The dew-point for July shows a slight increase with a lake wind, but the most marked effect is produced upon the relative humidity, especially at 3 p. m., during May and July, in which months the relative humidity at the two stations is 69 and 51 per cent., respectively, in May, and 67 and 45 per cent. in July.

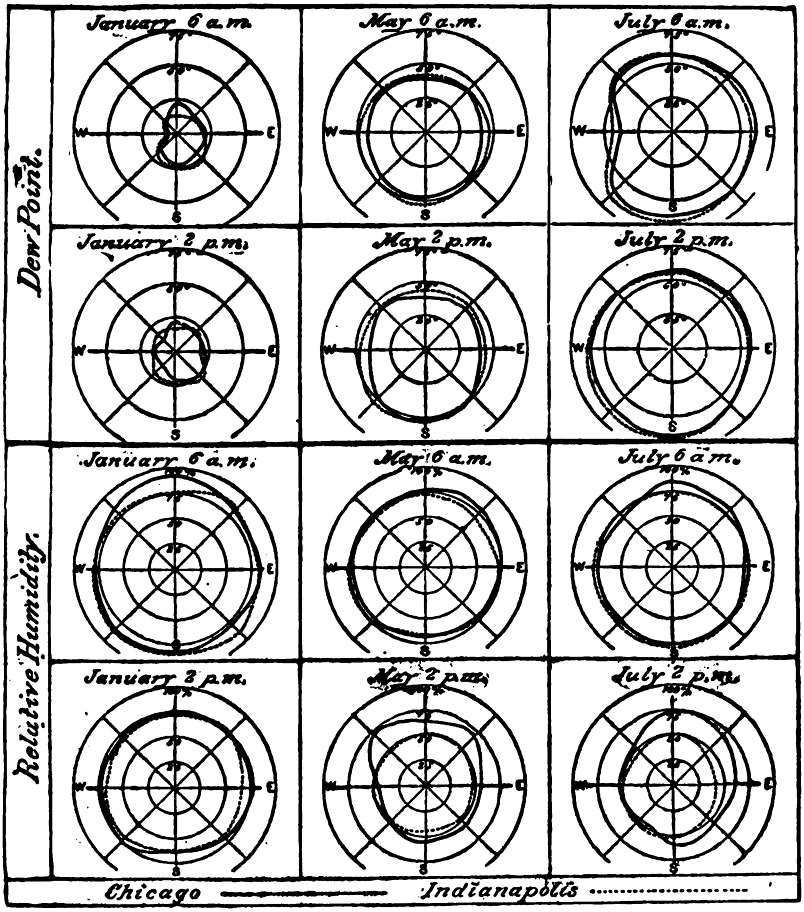


Fig. 6.—*Dew-point and relative humidity, with each wind, Chicago and Indianapolis.*

[illegible] *relative humidity with different winds*, 1882, 1883, 1884, 1885, *and* 1886.

CHICAGO.

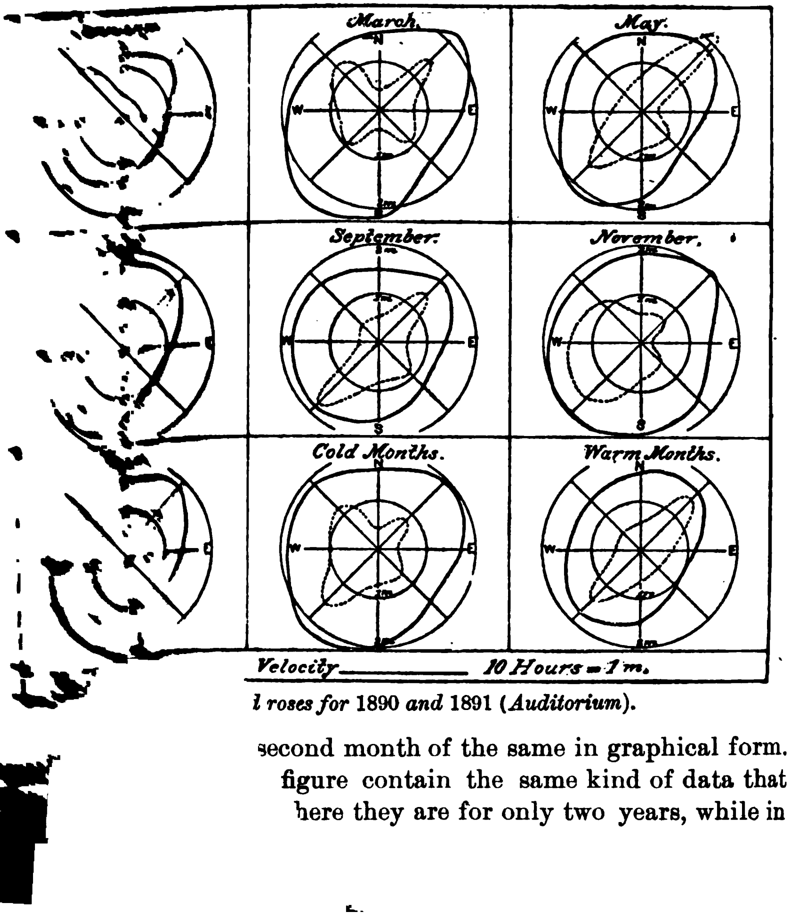
E.		SE.		S.		SW.		W.		NW.	
°	%	°	%	°	%	°	%	°	%	°	%
22	85	19	79	23	83	15	83	4	79	10	83
22	78	25	71	20	64	13	73	14	73	11	71
42	76	46	70	49	70	46	70	40	72	40	73
41	55	48	57	53	55	49	50	39	46	43	69
[illegible]	76	62	77	61	76	61	72	58	75	55	70
59	61	61	57	64	59	61	48	60	52	57	56

INDIANAPOLIS.

E.		SE.		S.		SW.		W.		NW.	
20	82	27	90	24	84	20	87	6	81	11	78
19	66	28	73	21	63	21	68	14	67	17	68
48	74	49	72	53	69	51	75	48	76	41	70
45	48	48	49	52	44	54	47	47	51	44	47
58	71	61	76	65	79	65	79	64	79	58	75
57	41	61	47	65	53	66	53	63	50	57	45

LAKE AND WIND VELOCITY.

[illegible] contains the relative number of hours of wind from [illegible] with the mean velocity for the years 1890 and 1891,



l roses for 1890 *and* 1891 (*Auditorium*).

second month of the same in graphical form. figure contain the same kind of data that here they are for only two years, while in

Fig. 1 are the records for 18 years. A remarkable agreement will be found on comparing these wind roses. It will be seen from Fig. 7 that the general tendency is for a greater velocity with northeast and southwest winds, and this was to be expected, for it is in the northeast direction that the greater lake surface extends, and this would assist the wind because of less friction in these two directions. It is to be noted, however, that in addition to the lake influence there is pretty good evidence of a general tendency all over this part of the country for the winds to assume these directions, as well as a slightly greater velocity from them. This seems to be a well defined law, and while the southwest wind may be accounted for from the fact that it is in the direction of general currents, the northeast wind cannot be so accounted for and demands still further investigation, and one that would seem to be of much importance.

TABLE XIII.—*Hours and average miles from each direction*, 1890 *and* 1891.

Months.	N.		NE.		E.		SE.	
	Hours.	*Miles.*	*Hours.*	*Miles.*	*Hours.*	*Miles.*	*Hours.*	*Miles.*
January	46	12.3	46	15.3	47	9.5	61	10.0
February	45	13.0	80	17.2	28	16.4	67	15.7
March	47	16.0	145	21.8	76	17.0	89	14.8
April	66	18.3	211	19.7	73	16.2	85	13.6
May	74	15.5	207	19.1	33	12.9	77	11.3
June	36	13.2	155	14.8	94	12.2	123	11.8
July	45	17.1	152	17.6	48	11.0	104	9.7
August	68	14.3	147	15.5	65	10.8	110	8.8
September	55	14.9	142	18.0	63	13.4	90	12.8
October	96	15.5	97	15.7	42	13.2	90	14.0
November	58	17.6	66	20.3	19	13.8	53	16.6
December	50	17.6	62	19.4	17	18.4	92	16.8
Year	57	15.7	126	18.5	50	13.7	87	12.9
Cold months	47	15.5	83	19.5	42	17.3	77	15.8
Medium months	74	16.7	145	18.7	42	14.0	76	13.6
Warm months	51	14.9	149	16.5	68	11.9	107	10.8

Months.	S.		SW.		W.		NW.	
	Hours.	*Miles.*	*Hours.*	*Miles.*	*Hours.*	*Miles.*	*Hours.*	*Miles.*
January	65	12.4	188	15.4	104	13.2	133	12.8
February	70	19.3	131	21.7	103	20.0	94	20.1
March	38	22.0	99	23.6	84	18.0	122	15.9
April	73	19.6	98	25.2	57	16.4	46	16.8
May	76	17.2	150	21.0	59	16.2	50	16.0
June	62	14.6	101	17.0	60	13.8	38	12.4
July	66	14.6	155	18.4	67	13.7	55	13.8
August	62	13.8	130	17.4	46	14.0	74	13.0
September	84	15.6	171	18.6	38	17.8	43	16.0
October	70	16.1	133	21.0	78	16.0	112	15.7
November	81	18.9	160	20.7	150	18.6	119	17.3
December	113	18.8	195	24.1	101	17.8	101	17.3
Year	72	17.2	143	20.2	79	16.8	82	15.8
Cold months	71	20.0	153	21.8	98	18.6	112	17.8
Medium months	75	18.0	137	22.0	86	16.8	82	16.5
Warm months	69	14.7	139	17.9	53	14.8	53	13.8

MEAN VELOCITY DURING STORMS.

It would be interesting to ascertain whether this law holds for winds occurring during the time of storms. Table XIV has be
prepared to show this effect. The corresponding wind roses (not

produced) show a similar tendency to a greater velocity with southwest and northeast winds, though this effect is not as marked as in Fig. 7, possibly in part because the winds of Fig. 7 were all observed on the Auditorium tower, and for that reason may exhibit such effects more clearly.

TABLE XIV.—*Mean velocity of wind during rainfall according to direction*, 1872–'89.

	N.	NE.	E.	SE.	S.	SW.	W.	NW.
	Miles.	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*	*Miles.*
January	11.1	12.5	8.1	8.6	8.3	12.7	11.0	10.4
February	8.8	12.1	11.0	9.1	8.6	11.8	13.6	9.9
March	14.1	13.1	11.6	10.7	10.3	11.8	12.1	11.3
April	12.2	11.5	12.0	8.6	10.6	10.6	9.9	10.5
May	12.4	12.4	9.1	8.1	7.8	9.8	8.8	8.7
June	10.7	7.7	7.2	5.8	8.7	9.5	7.2	8.5
July	9.4	7.9	7.2	6.6	7.7	8.2	6.5	7.1
August	11.1	9.4	7.6	6.5	8.0	7.3	6.6	6.5
September	11.1	11.0	10.1	9.0	8.7	8.6	9.0	8.1
October	11.4	11.5	6.9	8.0	11.0	12.0	10.3	9.7
November	9.7	13.8	7.8	10.3	9.4	11.3	11.0	11.5
December	9.0	11.5	10.0	8.4	9.4	11.7	10.2	8.7
Year	10.9	11.3	9.1	8.3	9.0	10.4	9.7	9.3
Cold months	10.8	12.3	10.2	9.2	9.2	12.0	11.7	10.1
Medium months	11.7	12.6	9.0	8.8	9.7	10.9	10.0	10.1
Warm months	10.6	9.0	8.0	7.0	8.3	8.4	7.3	7.6

LAND AND LAKE BREEZES.

Hourly observations of the velocity and direction of the wind have been made for a number of years, and these will enable us to determine quite accurately the occurrence of land and lake breezes. The existence of such breezes was demonstrated a good many years ago. One of these investigations will be found in Signal Service Note VI, p. 19, prepared in 1883. The illustration giving the hourly wind direction as computed by Lambert's formula for the months June–September, 1882, is here given in Fig. 8. Table XV contains hourly * wind directions for 1884, 1889, 1890, and 1891, and the last six months of 1888, and Fig. 9 is a graphic presentation of a portion of this table.

TABLE XV.—*Hourly wind directions.*

Year and months.	24.	1.	2.	3.	4.	5.	6.	7.
1884.	°	°	°	°	°	°	°	°
[illegible]	s 82 w	s 80 w	s 75 w	s 75 w	s 73 w	s 85 w	s 89 w	s 89 w
[illegible]	s 88 w	s 69 w	n 84 w	s 86 w	n 86 w	n 86 w	n 78 w	n 74 w
[illegible]	n 29 w	n 34 w	n 32 w	n 46 w	n 51 w	n 26 w	n 19 w	n 2 w
[illegible]	n 27 e	n 18 e	n 9 e	n 13 e	n 7 e	n 19 e	n 26 e	n 26 e
[illegible]	n 16 w	n 43 w	n 37 w	n 65 w	n 65 w	n 83 w	s 78 w	s 89 w
[illegible]	n 54 e	n 75 e	n 72 e	n 82 e	n 79 e	n 49 e	n 36 e	n 29 e
[illegible]	n 17 e	n 33 w	n 23 w	n 24 w	n 35 w	n 43 w	n 28 w	n 21 w
[illegible]	s 29 e	s 3 e	s 78 w	s 40 w	s 40 w	s 31 w	s 53 w	s 60 w
[illegible]	s 9 w	s 16 w	s 10 w	s 15 w	s 13 w	s 47 w	s 37 w	s 19 w
[illegible]	s 27 w	s 49 w	s 56 w	s 54 w	s 58 w	s 62 w	s 64 w	s 58 w
[illegible]	s 85 w	s 86 w	s 86 w	s 79 w	s 81 w	s 78 w	s 76 w	s 81 w
[illegible]	s 44 w	s 57 w	s 62 w	s 73 w	s 77 w	s 74 w	s 71 w	s 69 w

---

[illegible] hours are counted from 1 to 24, 24 being midnight.

TABLE XV.—*Hourly wind directions*—Continued.

Year and months.	8.	9.	10.	11.	12.	13.	14.	15.
1884.	°	°	°	°	°	°	°	°
January	s 88 w	s 87 w	s 86 w	s 80 w	s 77 w	s 73 w	s 72 w	s 70 w
February	n 78 w	n 75 w	n 71 w	s 89 w	n 62 w	s 79 w	s 52 w	s 81 w
March	n 2 e	n 5 e	n 9 e	n 69 e	n 62 e	n 43 e	n 29 e	n 17 e
April	n 10 e	n 21 e	n 20 e	n 29 e	n 29 e	n 28 e	n 29 e	n 29 e
May	s 89 w	n 75 w	n 62 w	n 13 w	n 4 w	n 21 w	n 17 w	n 3 w
June	n 47 e	n 40 e	n 34 e	n 39 e	n 37 e	n 36 e	n 36 e	n 38 e
July	n 46 w	n 29 w	n 16 e	n 24 e	n 63 e	n 66 e	n 74 e	n 76 e
August	s 70 w	s 45 w	s 50 w	n 20 e	n 37 e	n 53 e	n 42 e	n 62 e
September	s 20 w	s 21 w	s 29 w	s 20 w	s 48 w	s 38 w	s 28 w	s 23 w
October	s 60 w	s 67 w	s 67 w	s 77 w	s 84 w	s 81 w	s 79 w	s 70 w
November	s 78 w	s 74 w	s 75 w	n 89 w	s 79 w	s 75 w	s 79 w	s 75 w
December	s 69 w	s 67 w	s 76 w	s 74 w	s 72 w	s 63 w	s 44 w	s 48 w

Year and months.	16.	17.	18.	19.	20.	21.	22.	23.
1884.	°	°	°	°	°	°	°	°
January	s 70 w	s 67 w	s 65 w	s 80 w	s 80 w	s 79 w	s 78 w	s 79 w
February	s 87 w	n 39 w	n 53 w	n 48 w	n 73 w	n 85 w	n 85 w	n 83 w
March	n 17 e	n 2 w	n 9 w	n 24 w	n 28 w	n 29 w	n 26 w	n 34 w
April	n 32 e	n 37 e	n 45 e	n 43 e	n 24 e	n 15 e	n 25 e	n 24 e
May	n 3 w	n 84 e	n 84 e	n 73 e	s 86 e	s 68 e	s 86 e	s 36 e
June	n 35 e	n 32 e	n 11 e	n 20 e	n 25 e	n 20 e	n 42 e	n 49 e
July	n 75 e	n 32 e	n 29 e	n 24 e	n 30 e	n 23 e	n 23 e	n 27 e
August	n 45 e	n 61 e	n 68 e	n 72 e	n 58 e	n 72 e	n 79 e	s 77 e
September	s 14 w	s 14 w	s 3 w	s 2 e	s 4 e	s 2 e	s 2 w	s 7 w
October	s 71 w	s 51 w	s 30 w	s 41 w	s 32 w	s 36 w	s 39 w	s 52 w
November	s 75 w	s 62 w	s 67 w	s 82 w	s 83 w	s 88 w	s 84 w	s 85 w
December	s 58 w	s 60 w	s 64 w	s 61 w	s 56 w	s 59 w	s 60 w	s 53 w

Year and months.	24.	1.	2.	3.	4.	5.	6.	7.
1888.	°	°	°	°	°	°	°	°
July	n 83 e	s 71 e	s 33 e	s 54 e	s 37 e	s 37 e	s	s 71 e
August	s 51 w	s 75 w	n 82 w	s 80 w	s 67 w	s 73 w	s 50 w	s 60 w
September	s 30 e	s 13 w	s 46 w	s 42 w	s 42 w	s 38 w	s 35 w	s 32 w
October	s 70 w	s 67 w	s 60 w	s 63 w	s 65 w	s 69 w	s 63 w	s 73 w
November	s 85 w	s 86 w	s 86 w	n 88 w	s 78 w	s 78 w	s 82 w	s 85 w
December	s 73 w	s 80 w	s 71 w	s 75 w	s 72 w	s 74 w	s 76 w	s 81 w

Year and months.	8.	9.	10.	11.	12.	13.	14.	15.
1888.	°	°	°	°	°	°	°	°
July	s 49 e	s 14 e	s 75 e	s 78 e	n 59 e	n 62 e	n 69 e	n 51 e
August	s 32 w	s 51 e	s 34 w	n 82 w	s 32 e	s 59 e	s 63 e	n 79 e
September	s 54 w	n 83 w	n 70 w	n 59 w	n 45 e	n 49 e	n 50 e	n 51 e
October	s 63 w	s 73 w	s 53 w	s 47 w	s 57 w	s 42 w	s 79 w	s 45 w
November	s 85 w	s 83 w	n 81 w	n 76 w	n 52 w	n 50 w	n 35 w	n 16 w
December	s 77 w	s 67 w	s 66 w	s 66 w	s 59 w	s 66 w	s 63 w	s 55 w

Year and months.	16.	17.	18.	19.	20.	21.	22.	23.
1888.	°	°	°	°	°	°	°	°
July	n 42 e	n 45 e	n 77 e	n 66 e	n 64 e	n 83 e	e	s 84 e
August	n 65 e	n 22 e	s 45 e	s 13 e	s 24 e	s 18 w	s	s 28 w
September	n 60 e	n 58 e	n 79 e	s 10 e	s 83 e	s 38 e	s	s 23 w
October	s 86 w	n 45 e	s	s 82 w	s 71 w	s 85 w	s 72 w	s 69 w
November	n 41 w	n 35 w	n 58 w	n 66 w	n 72 w	n 75 w	n 80 w	n 75 w
December	s 62 w	s 64 w	s 67 w	s 73 w	s 70 w	s 74 w	s 75 w	s 75 w

TABLE XV.—*Hourly wind directions*—Continued.

Year and months.	16.	17.	18.	19.	20.	21.	22.	23.
1891.	°	°	°	°	°	°	°	°
January	s 85 w	s 80 w	s 56 w	s 62 w	s 65 w	s 63 w	s 78 w	s 84 w
February	s 60 w	s 51 w	s 62 w	s 63 w	s 75 w	s 65 w	s 79 w	s 76 w
March	n 35 e	n 28 e	n 45 e	n 32 e	n 45 e	n 45 e	n 74 e	n 85 e
April	n 66 e	n 73 e	n 76 e	n 50 e	n 70 e	n 67 e	n 89 e	n 74 e
May	s 87 e	s 86 e	s 88 e	s 86 e	s 85 e	s 67 e	s 54 e	s 40 e
June	n 63 e	n 78 e	n 86 e	s 85 e	s 83 e	s 89 e	s 77 e	s 81 e
July	s 88 e	s 81 e	s 63 e	s 43 e	s 30 e	s 3 w	s 5 e	s 1 e
August	s 82 e	n 84 e	n 87 e	s 62 e	s 47 e	s 45 e	s 15 w	s 58 w
September	s 30 e	s 35 e	s 18 e	s 27 e	s 2 e	s 6 e	s 10 w	s 10 w
October	s 63 w	s 45 w	s 83 w	s 80 w	s 81 w	s 74 w	s 78 w	s 72 w
November	s 2 e	s 40 w	s 76 w	s 51 w	s 42 w	s 65 w	s 66 w	s 74 w
December	s 3 w	s 3 w	s 15 w	s 2 w	s 14 w	s 29 w	s 37 w	s 42 w

The theory of these winds, and one almost universally accepted, is that during the day the land surface becomes heated considerably above that of water and there arises in the afternoon a tendency for the air to flow from above the water to the land, while at night the reverse action takes place, the land is greatly cooled by radiation to space and the air tends to flow in the contrary direction. This view makes the winds an aspiration effect, and this is known to be not wholly true, since on the shore of the ocean the sea breeze is seen to create a ripple first in the offing, and this ripple gradually approaches the land.

If these winds are merely aspiration airs, we would naturally expect that the velocity would be greatly diminished, especially if the land or lake breeze is opposite to the general trend of the wind, for, in one sense, such a breeze would have to first overcome the ordinary wind before it could flow at all in an opposite direction. It is to be noted that these land and lake breezes have only a very slight difference in their velocity.

There can be no doubt whatever of the existence of marked winds of this character during the warm months. On turning to Fig. 9, we see that from January to March and from October to December the general trend of the wind is from the west to east. According to the ordinary theory the land does not change its temperature so as to become opposite that of the water, but always remains cooler during [illegible] months, and, as a result, the ordinary trend of the wind is not changed. During the remaining months, however, the land and lake [illegible] are very marked. There is only one apparent exception, and [illegible] to emphasize the lake influence. It will be seen that in [illegible] the warmer months there is a well marked lake breeze at all [illegible] the day. This would be due to the fact that the air above [illegible]ce continues throughout the 24 hours slightly cooler [illegible]ve the land. The greatest interest attaches in this [illegible] height of the land and lake breezes above the surface [illegible] of change, and the velocity at different heights, [illegible]uestions, are of great importance.

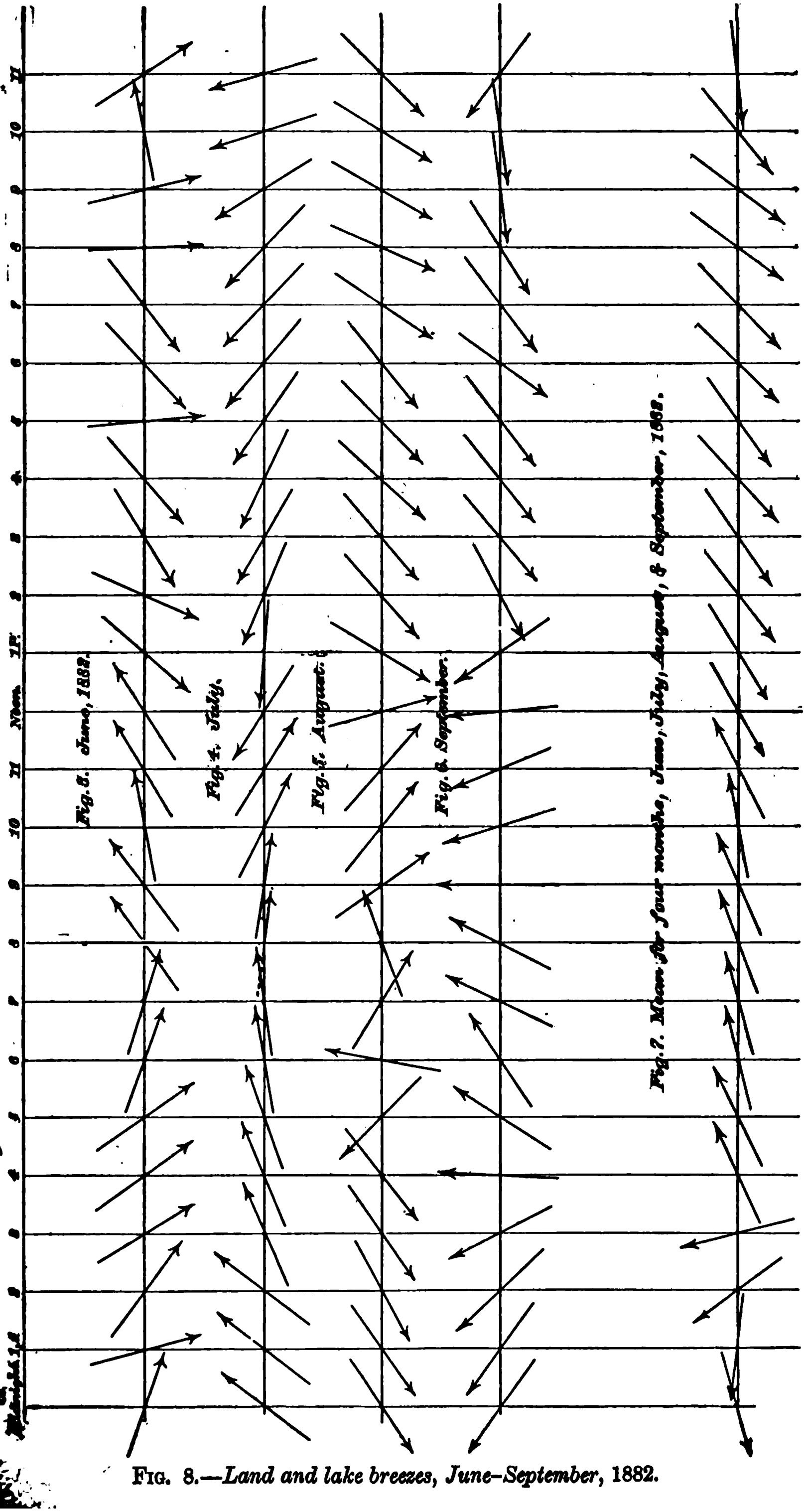


FIG. 8.—*Land and lake breezes, June–September*, 1882.

It is probably safe to say that a free balloon, if descending near the center of the lake during the warm season and in the afternoon, would be certainly driven landward at a velocity of 10 to 20 miles per hour.

These are the principal effects due to the lake influence though other minor effects will be noted later on. We will now pass to the second great division, or the general and average conditions of the meteorologic elements and the sharper fluctuations brought about by the passage of storms and high areas, warm and cold waves, etc.

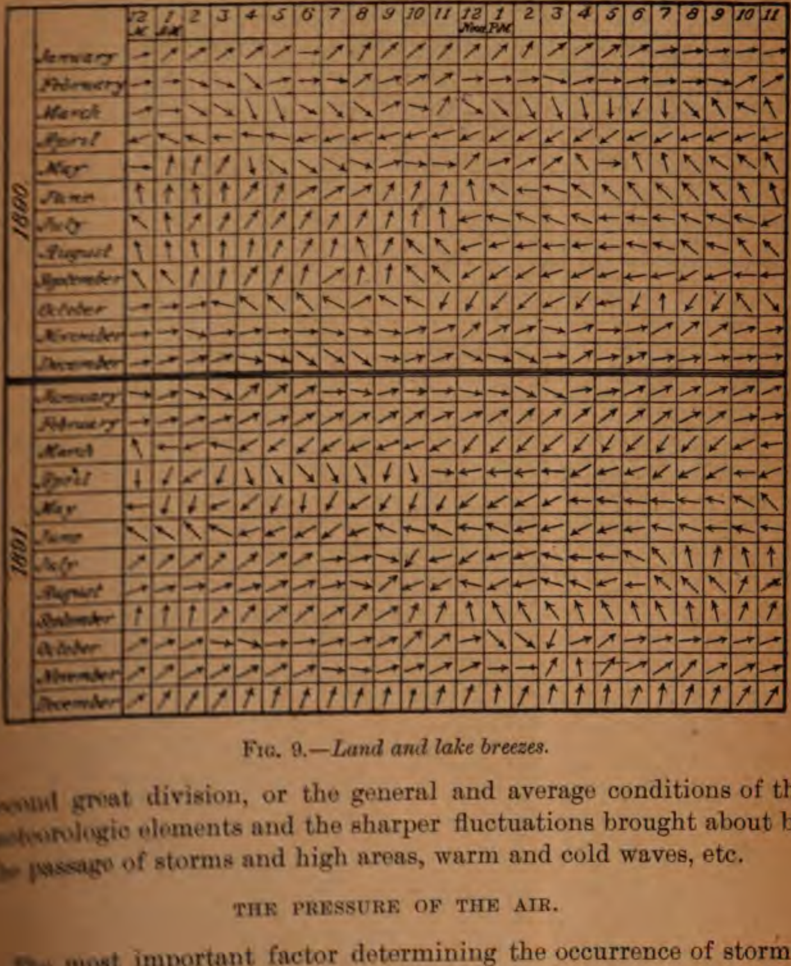
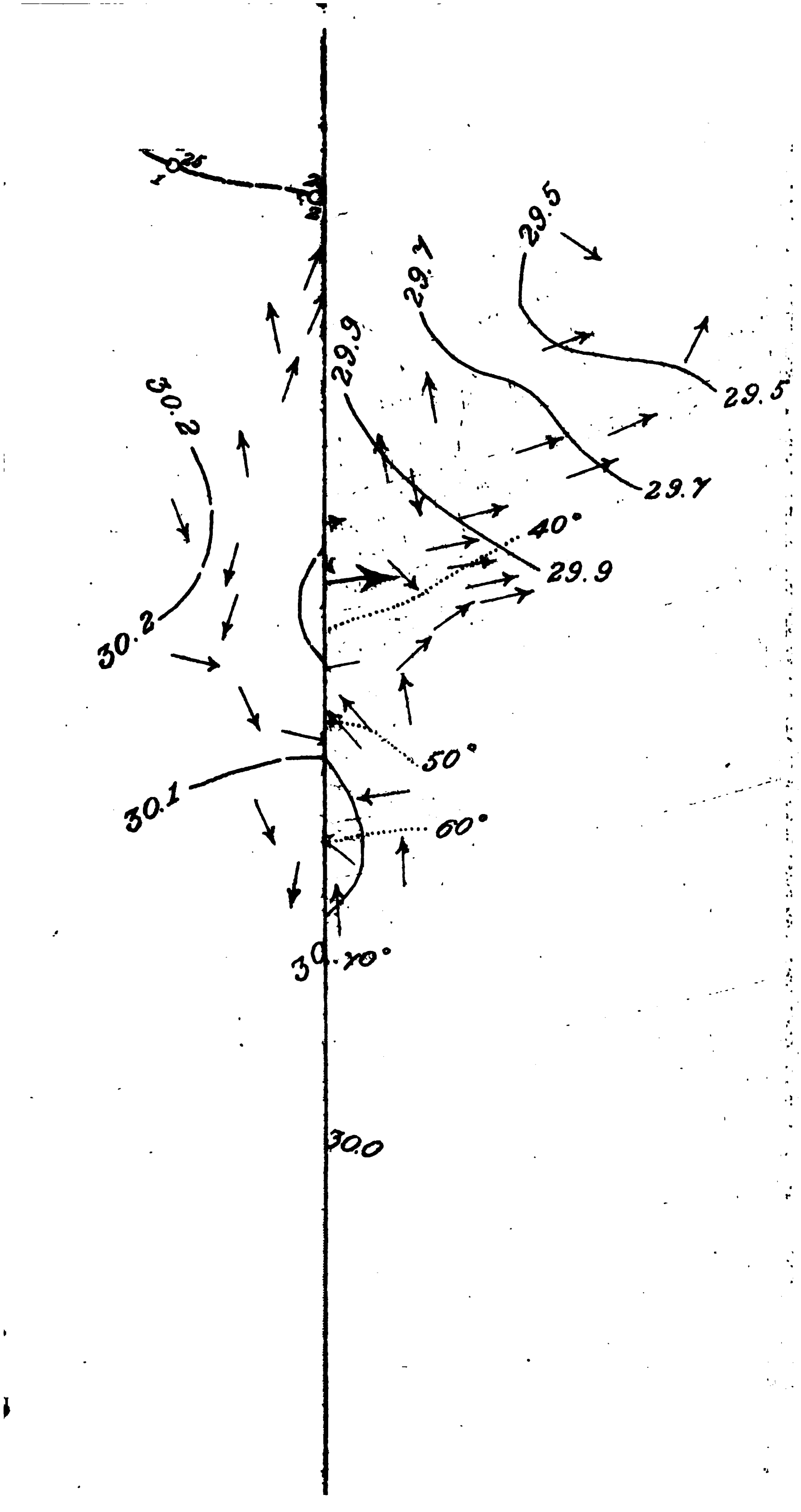


FIG. 9.—*Land and lake breezes.*

THE PRESSURE OF THE AIR.

The most important factor determining the occurrence of storms, cold waves, and other weather changes is what is commonly called [illegible] "barometer reading," or "barometer" for short. The barometer [illegible] the pressure, or, more strictly speaking, the weight of the [illegible]

[illegible] advances in meteorology have been made by compar- [illegible] have been reduced to a common plane, the readings of [illegible] stations some distance apart over a large region. In [illegible] been found that isobars, or lines joining equal



25
1
29.5
29.7
29.9
29.5
30.2
29.7
40°
29.9
30.2
50°
30.1
60°
30.70°
30.0

It is probably safe to say that a free balloon, if descending near the center of the lake during the warm season and in the afternoon, would be certainly driven landward at a velocity of 10 to 20 miles per hour.

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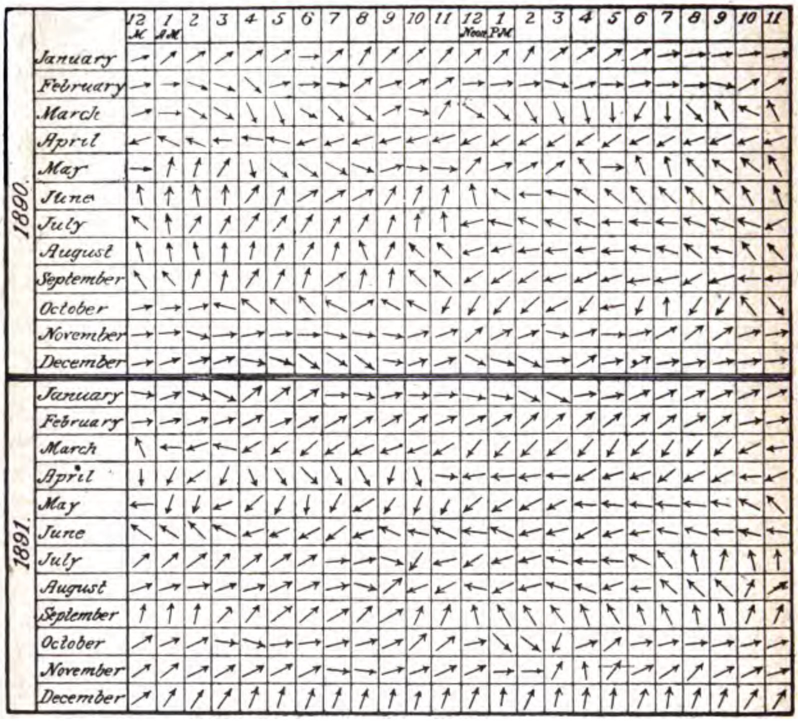
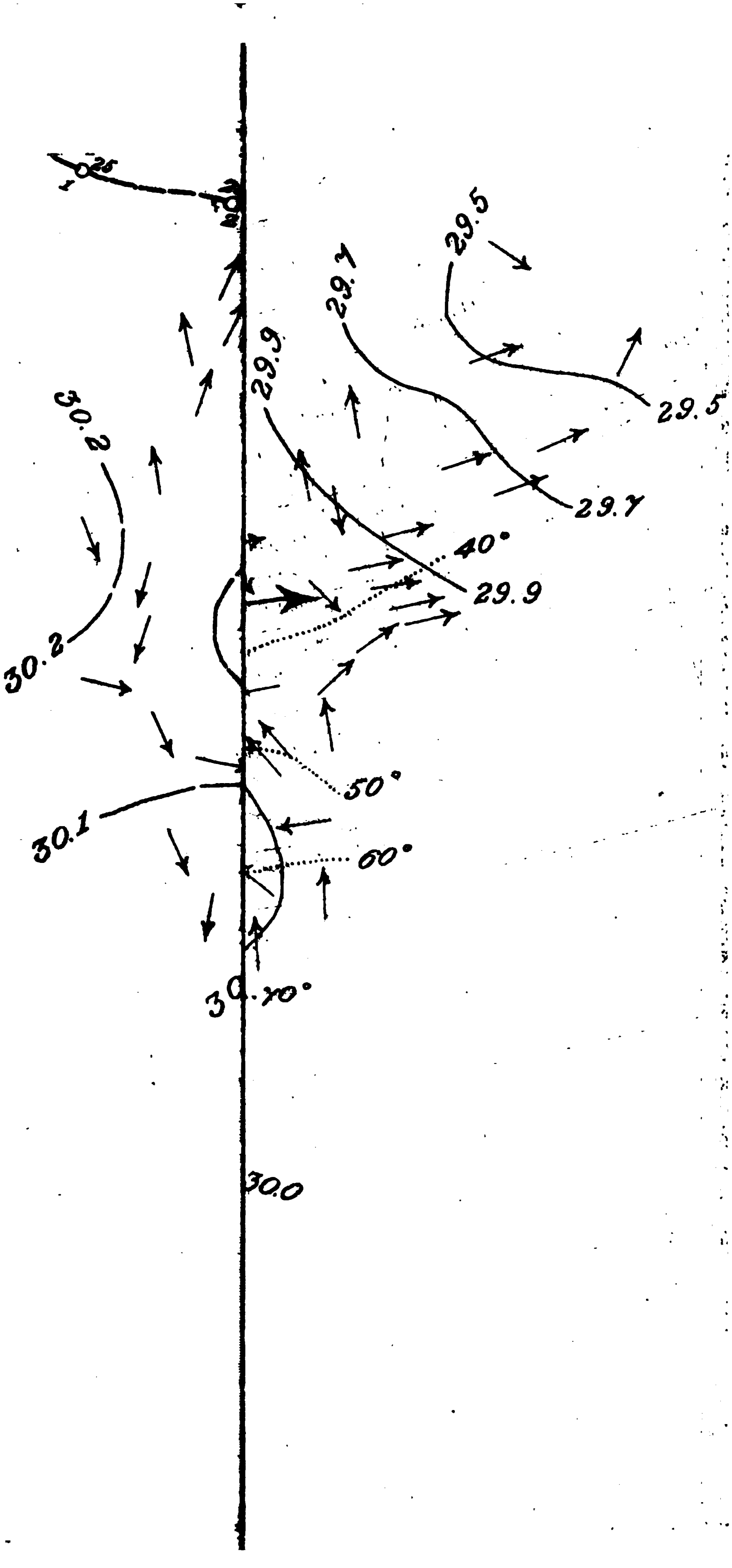


FIG. 9.—*Land and lake breezes.*

THE PRESSURE OF THE AIR.

The most important factor determining the occurrence of storms, cold waves, and other weather changes is what is commonly called the "barometer reading," or "barometer" for short. The barometer measures the pressure, or, more strictly speaking, the weight of the air.

The greatest advances in meteorology have been made by comparing, after they have been reduced to a common plane, the readings of barometers at stations some distance apart over a large region. In this way it has been found that isobars, or lines joining equal


25
29.5
29.7
30.2
29.9
29.5
29.7
40°
29.9
30.2
50°
30.1
60°
30.70°
30.0

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

barometer readings at sea level, map out larger or smaller oval spaces. These ovals, especially in the colder months and in latitudes above the tropics, are quite regular and wide extended. They represent what may be designated elevations or "highs" in the atmosphere, where the pressure is relatively high; or hollows, "lows," where the pressure is relatively low.

There is given in Fig. 10 a chart or weather map indicating the state of pressure, temperature, and wind direction at 8 p. m. (Eastern time) on March 27, 1890. It will be remembered that just at this time severe tornadoes were raging in Kentucky, and this gives an added interest to this map. It will be seen that the full lines or isobars inclose an oval space central over Illinois. These lines also map out the wind arrows, which are seen to point in a direction counter-clock-wise about the low center. The dotted temperature lines, or isotherms, show a well marked rise in the front of the storm and a similar fall in the rear. These characteristics will be found to be a general law as applied to storms, and the contrary is true of high areas. That is, the wind has a tendency to flow outward from the center of a high area, and their directions go about the oval with the hands of a clock. The air in front is much cooled and dry, while in the rear it is heated and becoming moist.

MEAN TEMPERATURE AT CHICAGO.

The temperature observations at Chicago began in July, 1832, at Fort Dearborn, a station near Lake Michigan. These were continued till December, 1836, after which month there is a gap till November, 1859, relieved only by six months observations during 1844 and all of 1857. These observations were made with every kind of exposure, and generally at 7 a. m., 2 p. m., and 9 p. m., until November, 1870, when the Signal Service record begins. The shelter of the Signal Service was placed at north windows of rather high buildings until January 1, 1887, when they were transferred to the roof. On February 1, 1890, the shelter was placed on the Auditorium building, at a height of 241 feet above the ground, giving by far the best exposure thus far obtained.

The hours of observation have been changed from time to time. Until November, 1879, they were mostly at 7.35 a. m., 4.35 and 11 p. m., Washington time, or 50 minutes earlier than Chicago time. From November, 1879, to July, 1888, they were at 7 a. m., 3 and 11 p. m., and since July, 1888, they have been taken at 8 a. m. and 8 p. m. During nearly the whole time the daily extremes have been observed by self-registering maximum and minimum thermometers, and since July, 1888, the mean temperature used in publications has been the $\frac{\text{max.} + \text{min.}}{2}$. Until July, 1881, daily observations were also made at

[illegible] p. m., local time. A careful study of all these records has
[illegible] to July, 1888, the mean of the three telegraphic obser-
[illegible] differed but very slightly from the mean obtained from
[illegible] Since July, 1888, the mean of the $\frac{8 + 8}{2}$ has been
[illegible] below the true mean, and the mean of the maximum
[illegible] has been about a half degree too high. It will thus be
[illegible] mean of the four $\frac{8 \text{ a. m.} + 8 \text{ p. m.} + \text{max.} + \text{min.}}{4}$
[illegible] much nearer approximation, generally speaking, than
[illegible] and minimum alone. There is, however, a slight
[illegible] which tends to cause the minimum to read too low, and
[illegible] not always constant. It seems advisable, for the
[illegible] to take the mean of the maximum and minimum,
[illegible] that this is liable to be a half degree too high. The
[illegible] as will be seen presently, is small as compared

[illegible] interesting and of considerable value in discussing
[illegible] extended period, if we could obtain interpolated
[illegible] during which there are no records. This could
[illegible] accuracy if we had a long series of observa-
[illegible] station which lapped over those at Chicago.
[illegible] no records of this description near Chicago,
[illegible] series at two or more stations which over-
[illegible] these it has been possible to interpolate
[illegible] make a complete record from 1830 to 1891.
[illegible] a record has been kept at Chicago, the tem-
[illegible] nearest tenth of degree, but in all interpolated
[illegible] degree is given.

[illegible] upon a definite exposure to which to reduce
[illegible] The best of all the exposures is un-
[illegible] Auditorium building, where the ther-
[illegible] ground, and the attempt has been made
[illegible] uniform with those made since Feb-
[illegible] noted, however, that these temperatures
[illegible] strictly to portions of the city at some
[illegible] and on the street. The temperature of
[illegible] is that of a considerable stratum
[illegible] affected by disturbing radiations or re-
[illegible] the presence of the lake complicates
[illegible] perature very much, and it is prob-
[illegible] ould be found in properly exposed
[illegible] tance above the street, especially

[illegible] posure of a thermometer above the roof of a building is objectionable because the highly heated tin roof and the heat escaping from the lower rooms would tend to raise the temperature, but experience has shown that the most important consideration is a perfect natural ventilation, and nearly everything else should be sacrificed for that. Still others think that the temperature needed is that at the level of the head on the sidewalk, but here we meet with a serious difficulty, in that in summer the temperature on the south side of the street is much lower than that on the north side, and in many cases it is lower even than that of a properly exposed thermometer.

It would appear that the earliest records, namely, those at Fort Dearborn, correspond fairly well with the present exposure though they may be very slightly lower. There were no large buildings about, and the exposure near the lake was quite satisfactory. The temperatures for the colder months, 1861–1865, seem to be a little too low. I have followed Mr. Schott in all cases, though the discrepancies between different series of observations in the city are often quite large. To show some of these I have drawn off Tables XVI and XVII.

Table XVI.—*Temperature at 7 a. m., 2 and 9 p. m., at different places in Chicago.*

Month.	7.	2.	9.	Mean.	Place.	Month.	7.	2.	9.	Mean.	Place.
1862.											
	°	°	°	°			°	°	°	°	
February	20.3	27.1	23.0	23.3	U.	September	64.4	71.5	66.0	67.0	U.
Do	14.3	25.5	17.0	18.4	B.	Do	56.3	70.3	58.0	60.6	B.
March	32.7	37.0	34.1	34.5	U.	October	51.9	59.6	54.1	54.9	U.
Do	26.4	34.0	29.3	29.7	B.	Do	42.6	56.8	45.4	47.5	B.
April	43.8	47.9	44.7	45.3	U.	November	34.8	39.1	36.2	36.6	U.
Do	37.4	47.9	38.8	40.7	B.	Do	28.1	39.3	30.6	32.1	B.
August	72.0	77.3	72.8	73.7	U.	December	29.7	36.8	31.3	32.3	U.
Do	65.9	77.5	64.6?	68.1	B.	Do	24.5	34.9	26.9	28.3	B.
1867.											
February	26.5	37.3	31.4	31.6	R.	July	69.5	79.1	71.5	72.9	R.
Do	24.9	36.6	29.2	30.0	B.	Do	72.2	82.3	69.3?	73.3	B.
March	26.5	38.1	29.0	30.6	R.	August	70.4	80.8	73.7	74.6	R.
Do	24.8	34.7	27.1	28.4	B.	Do	71.4	85.1	70.4?	74.3	B.
April	43.4	53.4	44.6	46.5	R.	September	62.1	75.6	66.9	67.9	R.
Do	44.5	55.1	43.2?	46.5	B.	Do	63.2	77.2	63.7	67.0	B.
May	48.7	56.7	48.4	50.6	R.	October	51.3	63.0	56.6	56.9	R.
Do	49.5	57.6	48.0?	50.8	B.	Do	49.6	65.3	53.1	55.3	B.
June	68.9	78.2	70.2	71.9	R.	December	27.1	33.2	29.1	29.6	R.
Do	72.2	84.2	67.8?	73.0	B.	Do	23.9	33.0	27.3	27.9	B.
1868.											
January	14.6	23.9	19.7	19.5	R.	July	78.2	86.4	78.7	80.5	R.
Do	11.4	24.1	15.0	16.4	B.	Do	79.7	89.7	76.8?	80.8	B.
February	19.4	33.3	27.2	26.8	R.	August	69.2	79.0	70.9	72.5	R.
Do	15.5	32.1	21.5	22.6	B.	Do	68.1	82.3	67.1?	71.2	B.
March	38.2	50.5	43.2	43.8	R.	September	58.7	70.1	60.9	62.6	R.
Do	36.0	49.6	39.4	41.1	B.	Do	56.8	70.0	57.0	60.0	B.
April	42.0	51.5	44.3	45.5	R.	October	49.4	58.0	50.3	52.0	R.
Do	39.2	52.0	41.0	43.3	B.	Do	46.0	56.7	47.8	49.6	B.
May	52.9	60.5	52.7	54.7	R.	November	38.3	46.2	41.4	41.8	R.
Do	51.3	60.5	51.7	53.8	B.	Do	29.9	40.3	33.1	34.1	B.
June	63.1	72.5	65.2	66.5	R.	December	22.0	29.5	24.5	25.1	R.
Do	63.2	76.2	61.3?	65.5	B.	Do	16.6	25.4	19.0	20.0	B.

Note.—U., University; B., Brooks; R., Randolph street.

[illegible]—Temperature recorded at different localities in Chicago.

May.	June.	July.	August.	September.	October.	November.	December.	Locality.
°	°	°	°	°	°	°	°	
[illegible]	[illegible]	73.1	73.7	67.0	54.9	36.6	32.3	University.
[illegible]	[illegible]	68.0	68.2	60.6	47.6	32.2	28.3	Brooks.
......	......	......	......	......	......	......	......	University.
[illegible]	......	65.6	65.6	......	......	......	......	Brooks.
[illegible]	......	......	......	......	......	......	......	University.
[illegible]	......	......	......	......	......	......	17.8	Brooks.
[illegible]	71.9	72.9	74.6	67.9	56.9	44.8	29.6	Randolph st.
[illegible]	73.0	73.3	74.3	67.0	55.3	42.2	27.9	Brooks.
[illegible]	66.5	80.5	72.5	62.6	52.0	41.8	25.1	Randolph st.
[illegible]	69.5	80.8	71.2	60.0	49.6	34.1	20.0	Brooks.
[illegible]	65.2	73.0	73.1	66.8	45.6	35.8	30.2	Randolph st.
[illegible]	63.4	69.4	71.0	63.0	40.8	31.9	26.9	Brooks.
[illegible]	71.3	78.8	74.7	70.0	56.2	43.2	27.6	Randolph st.
[illegible]	67.3	74.8	70.6	67.4	54.1	41.4	26.5	Brooks.
[illegible]	66.8	73.0	72.7	61.0	......	35.0	20.0	Signal Service.
[illegible]	71.6	77.1	75.9	......	......	......	......	University.
[illegible]	68.4	74.0	73.3	61.6	56.2	36.0	21.7	Brooks.
[illegible]	63.3	70.9	71.8	60.4	53.4	34.2	19.5	Evanston.
[illegible]	69.3	71.7	72.1	64.0	50.2	31.9	19.1	Signal Service.
[illegible]	70.4	73.1	72.4	64.6	51.8	32.7	19.7	University.
[illegible]	70.0	73.5	72.9	67.7	50.8	31.2	19.3	Brooks.
[illegible]	68.9	72.2	73.5	65.4	50.3	31.1	17.5	Evanston.
[illegible]	70.3	70.8	72.1	62.1	48.9	34.3	32.0	Signal Service.
......	......	......	......	......	......	......	......	University.
[illegible]	70.5	72.2	74.3	62.9	47.0	31.8	30.0	Brooks.
[illegible]	65.3	70.6	72.6	62.3	46.7	......	......	Evanston.

[illegible] deemed it the wisest to take the mean of discordant [illegible] Chicago. Most of the discordances are probably due [illegible] that some of the exposures were much nearer the lake [illegible]. One interesting fact is brought out in Table XVI, in [illegible], the 9 p. m. observation, ordinarily very near the [illegible] the day, and always higher than that at 7 a. m., is fre[illegible] than the 7 a. m. This occurs in the summer months [illegible], for example, August, 1862, —1.3°; April, 1867, [illegible]; June, —3.4°; July, —2.9°; August, —1.0°. [illegible]; July, —2.9°; August, —1.0°. Now this anomaly [illegible] the fact that the sun struck the thermometer in the [illegible], but it is more probable that this exposure was near [illegible] the ground, if so, the lake breeze would tend to [illegible] near the lake and near the ground very rapidly, [illegible] approached, the land breeze would tend to heat up [illegible], and this effect would be heightened from the [illegible] shining at the 7 a. m. observation. Whatever [illegible] is a most interesting one, and it has seemed [illegible] observations for others who are interested [illegible]. The Auditorium temperature at 9 p. m. is [illegible] during June, July, and August.

[illegible] records previous to February, 1890, have a [illegible] temperature, especially when compared with those on the Auditorium. This may be shown approximately by comparing the observations at Chicago with those at Milwaukee, a station having very much the characteristics of the former. It should be noted, however, that the exposures at Milwaukee have changed from time to time, so that we have not there an invariable standard of comparison.

Table XVIII gives the mean temperature for January, February, March, November, and December, for each lustrum of 5 years, and also for May, June, July, August, and September.

TABLE XVIII.—*Mean temperature at Chicago and Milwaukee.*

Years.	Cold months.			Warm months.		
	Chicago.	Milwaukee.	Difference.	Chicago.	Milwaukee.	Difference.
	°	°	°	°	°	°
1856–1860........	26.7	26.7	0.0	63.7	62.6	1.1
1861–1865........	27.0	28.4	—1.4	63.3	63.0	0.3
1866–1870........	29.4	27.3	2.1	67.0	62.8	4.2
1871–1875........	29.5	24.9	4.6	66.1	63.1	3.0
1876–1880........	33.3	28.5	4.8	67.0	63.8	3.2
1881–1885........	30.2	26.3	3.9	65.2	61.8	3.4
1886–1890........	30.6	26.0	4.6	67.4	62.4	5.0
Feb., 1890.......	*31.5	28.9	2.6	*63.8	62.2	1.6

*Auditorium.

The higher temperatures in the later years till February, 1890, are due to the fact that they were taken in window shelters. It might be thought advisable to apply some correction to the observed values in order to reduce them to a common exposure, but, on the whole, it has been decided to publish the records as they stand, and each one can apply a correction to suit himself.

Table XIX contains the mean temperature by months and years, made up as has just been described for 62 years, 1830–1891. A mean for 20, 21, and 21 years is made up at the foot of the table, and a final mean for the 62 years. These means, in most cases, are made out to the nearest tenth of a degree, though it should be noted that even the mean for 62 years does not represent the exact mean nearer than a half degree, probably in each month, and it would be impossible to say whether this was a half degree higher or lower than the Auditorium, but probably it is higher.

TABLE XX.—*Five coldest and warmest months at Chicago.*

January.		February.		March.		April.		May.		June.		July.		August.		September.		October.		November.		December.	
Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.	Year.	Temperature.
COLDEST MONTHS.																							
	°		°		°		°		°		°		°		°		°		°		°		°
1834	13	1832	15	1836	26	1837	38	1837	48	1836	59	1836	66	1835	65	1835	54	1833	46	1838	25	1831	15
1856	13	1835	14	1843	16	1838	40	1838	50	1842	59	1837	66	1836	62	1836	57	1843	44	1839	31	1856	18
1857	11	1838	11	1856	27	1852	39	1849	50	1862	57	1861	66	1837	65	1839	54	1863	40	1842	30	1859	16
1883	16	1843	13	1864	27	1857	35	1857	50	1863	59	1863	66	1842	65	1840	56	1864	43	1857	30	1864	18
1888	15	1875	15	1866	26	1864	39	1861	49	1864	61	1865	63	1856	65	1841	57	1869	43	1880	31	1872	19
WARMEST MONTHS.																							
1845	35	1834	35	1838	42	1830	53	1833	60	1867	72	1846	78	1846	75	1844	69	1830	57	1830	45	1874	34
1846	39	1877	36	1842	45	1839	53	1846	62	1873	70	1866	77	1867	74	1870	69	1839	59	1846	43	1875	37
1863	34	1878	36	1846	42	1842	52	1870	62	1874	70	1868	81	1876	74	1881	70	1879	60	1849	45	1877	43
1876	33	1880	35	1868	42	1844	55	1880	64	1880	70	1870	77	1878	74	1884	69	1882	57	1867	44	1881	37
1880	40	1882	38	1878	44	1878	52	1881	61	1890	70	1887	76	1881	75	1891	69	1886	57	1878	43	1891	35
COLDEST MONTHS.																							
1857	11	1838	11	1843	16	1857	35	1837	48	1862	57	1865	63	1836	62	1835	54	1863	40	1838	25	1831	15
SIGNAL SERVICE.																							
1888	15	1875	15	1872	28	1874	39	1882	52	1889	62	1891	67	1890	68	1888	60	1887	47	1880	31	1872	19
WARMEST MONTHS.																							
1880	40	1882	38	1842	45	1844	55	1880	64	1867	72	1868	81	1881	75	1881	70	1879	60	1849	45	1877	43
SIGNAL SERVICE.																							
1880	40	1882	38	1878	44	1878	52	1880	64	*1890	70	1878	75	1881	75	†1891	69	1879	60	1878	43	1877	43

*June, 1874, 70.5°, not as hot.

†September, 1881, 69.5°, not as hot.

In Table XX are given the 5 coldest and warmest months in the series, also the coldest and warmest for the whole series and for the Weather Service. It will be noted that the Auditorium has four of the values in the last two sets.

Table XXI contains a summary of Table XIX by seasons.

TABLE XXI.—*Mean temperature of Chicago by seasons.*

Year.	Winter.	Spring.	Summer.	Autumn.	Mean.
	°	°	°	°	°
[illegible]	21.3	45.7	70.3	47.3	46.2
[illegible]	18.0	47.0	70.0	52.3	46.8
[illegible]	30.2	48.0	68.8	49.8	49.2
[illegible]	27.4	46.2	69.5	48.9	48.0
[illegible]	23.9	43.0	65.1	45.5	44.4
[illegible]	23.0	40.7	62.3	45.9	43.0
[illegible]	24.1	38.0	64.0	49.7	44.0
[illegible]	20.7	44.0	69.7	43.7	44.5
[illegible]	25.3	47.3	66.7	48.0	46.8
[illegible]	25.3	47.0	66.7	46.7	46.4
[illegible]	23.7	43.7	67.7	47.3	45.6
[illegible]	26.7	49.7	63.7	47.7	47.0
[illegible]	20.4	38.0	67.7	47.3	43.4
[illegible]	28.3	50.8	68.5	50.2	49.4
[illegible]	33.0	49.3	71.0	50.3	50.9
[illegible]	31.0	51.0	72.3	54.0	52.1
[illegible]	28.0	44.0	69.3	52.0	48.3
[illegible]	31.0	46.7	68.7	49.7	49.0
[illegible]	23.3	43.3	67.3	52.3	46.6
[illegible]	28.0	42.0	70.4	51.7	48.0
[illegible]	29.7	46.0	68.0	51.3	48.8
[illegible]	25.7	42.7	69.0	51.0	47.1
[illegible]	28.9	44.7	67.7	50.4	47.9
[illegible]	26.0	45.3	70.7	53.3	48.8
[illegible]	24.0	45.0	66.6	48.3	46.0
[illegible]	17.3	40.7	68.0	47.7	43.4
[illegible]	19.9	37.6	67.8	47.2	43.1
[illegible]	27.8	43.7	70.4	49.3	47.8
[illegible]	28.0	44.7	69.0	47.0	47.2
[illegible]	20.2	45.1	66.7	45.8	44.4
[illegible]	23.9	41.3	66.0	47.8	44.8
[illegible]	22.5	42.3	65.3	49.8	45.0
[illegible]	28.1	42.2	63.5	43.4	44.3
[illegible]	22.0	40.6	65.5	44.6	43.2
[illegible]	20.3	42.0	64.7	49.4	44.1
[illegible]	18.6	40.5	71.8	51.8	45.7
[illegible]	25.5	42.2	73.3	55.7	49.2
[illegible]	23.8	47.0	72.8	50.0	48.4
[illegible]	27.7	42.6	69.2	47.3	46.7
[illegible]	27.3	47.8	72.9	55.4	50.8
[illegible]	29.7	49.7	70.8	50.2	50.1
[illegible]	22.8	43.8	71.1	48.5	46.6
[illegible]	21.2	43.7	71.1	48.4	46.1
[illegible]	30.4	44.8	72.4	53.2	50.2
[illegible]	22.0	43.3	66.8	48.5	45.2
[illegible]	33.9	46.5	71.5	49.7	50.4
[illegible]	26.1	43.9	70.1	53.6	48.4
[illegible]	36.6	50.7	71.3	53.7	53.1
[illegible]	24.2	47.8	70.1	54.3	49.1
[illegible]	35.0	50.2	71.6	48.2	51.2
[illegible]	22.4	44.9	70.3	55.1	48.2
[illegible]	34.5	45.3	67.8	54.4	50.5
[illegible]	21.8	43.0	67.8	51.3	46.0
[illegible]	25.7	45.1	67.7	55.0	48.4
[illegible]	21.1	42.7	69.1	52.3	46.3
[illegible]	26.6	47.7	69.9	53.6	49.5
[illegible]	23.4	46.2	70.0	49.3	47.2
[illegible]	22.1	42.8	69.8	50.2	46.2
[illegible]	26.9	47.7	67.8	50.3	48.2
[illegible]	34.6	42.5	70.0	51.2	49.6
[illegible]	[illegible]	43.7	67.2	51.8	48.1
[illegible]	[illegible]	45.3	68.0	49.0	47.0
[illegible]	[illegible]	43.2	68.4	49.3	46.3
[illegible]	[illegible]	45.5	69.7	51.6	48.5
[illegible]	[illegible]	44.6	68.7	50.0	47.3

The means of the annual temperatures observed by the Weather Service are here given in lustra, or periods of 5 years: 1871–1875, 47.8°; 1876–1880, 50.2°; 1881–1885, 48.0°; 1886–1890, 48.2°.

Table XXII shows the mean temperature for each five days from the beginning, or the mean by pentads.

TABLE XXII.—*Mean temperature of Chicago by pentads.*

(Each figure in this table is the mean of five days' observations, or of fifteen observations of temperature up to July, 1888.)

Year.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12	13.	14.	15.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1870 ..	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1871 ..	30	28	42	26	25	36	31	27	24	34	40	35	39	46	45
1872 ..	31	29	30	29	14	8	14	18	24	27	35	34	24	27	28
1873 ..	26	24	34	17	22	9	20	28	27	34	10	25	21	39	39
1874 ..	37	30	16	32	26	33	25	28	38	35	29	34	41	30	32
1875 ..	17	10	14	13	27	29	16	6	9	12	27	17	21	30	34
1876 ..	41	33	26	36	30	32	18	36	43	30	30	40	43	43	32
1877 ..	14	18	14	23	16	37	42	37	36	34	38	34	25	24	27
1878 ..	24	26	35	38	33	31	30	37	32	38	39	40	46	51	45
1879 ..	—5	14	26	18	33	37	29	33	22	28	29	25	39	52	32
1880 ..	42	45	36	43	39	37	23	30	38	37	39	47	46	33	27
1881 ..	22	12	18	22	25	19	18	33	25	21	22	29	28	34	36
1882 ..	27	37	30	22	26	30	36	40	45	40	27	25	41	32	33
1883 ..	19	18	36	19	9	27	10	10	28	29	30	31	32	28	35
1884 ..	4	14	25	20	17	34	29	31	24	35	24	25	16	28	38
1885 ..	24	36	22	4	12	9	29	20	3	4	15	35	36	29	29
1886 ..	37	16	19	19	14	26	7	32	41	28	34	23	29	33	37
1887 ..	4	4	23	18	32	24	16	30	24	31	29	29	31	39	33
1888 ..	21	22	3	5	16	21	30	7	20	33	32	27	23	32	27
1889 ..	34	29	28	29	29	25	30	16	19	23	7	27	38	32	47
1890 ..	39	31	35	24	17	38	40	27	35	40	25	24	15	32	27
1891 ..	28	30	27	30	29	35	21	31	33	33	36	17	24	30	33
Mean.	24.6	24.1	25.7	23.2	23.4	27.5	24.5	26.5	28.1	29.8	28.4	29.7	31.3	34.5	34.1

Year.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1870 ..	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
1871 ..	41	38	39	50	59	43	51	47	52	46	46	55	62	64	70
1872 ..	24	31	34	38	49	46	44	53	54	50	64	51	57	55	58
1873 ..	38	29	39	51	40	44	41	37	45	48	50	49	52	62	61
1874 ..	46	36	34	31	36	43	40	40	41	43	63	58	50	62	73
1875 ..	20	38	50	45	54	42	31	37	46	44	56	50	57	61	62
1876 ..	22	34	34	39	44	48	48	50	52	44	50	58	71	58	70
1877 ..	28	31	40	40	41	45	50	54	42	46	47	57	63	52	63
1878 ..	41	42	41	47	50	49	58	57	52	54	54	48	58	62	56
1879 ..	30	41	43	33	47	42	42	64	55	50	51	63	58	57	65
1880 ..	39	40	42	50	42	46	50	49	49	65	68	56	68	65	64
1881 ..	33	32	30	26	35	37	43	54	53	47	64	68	55	59	73
1882 ..	39	39	43	52	46	36	50	43	48	49	57	44	57	51	53
1883 ..	26	32	37	40	44	55	47	42	45	47	52	48	59	52	55
1884 ..	38	46	42	40	37	48	41	44	56	55	54	54	60	64	51
1885 ..	16	32	38	41	43	38	47	55	47	47	42	56	56	58	56
1886 ..	45	41	34	31	44	52	57	58	54	57	53	56	54	62	61
1887 ..	29	32	25	40	52	56	42	45	50	59	56	59	60	65	58
1888 ..	37	24	36	44	43	44	43	41	57	50	53	44	48	61	59
1889 ..	38	43	36	40	47	43	56	50	47	50	76	52	66	51	49
1890 ..	39	39	30	42	45	46	42	51	48	47	45	49	49	63	67
1891 ..	35	35	40	34	37	46	54	54	58	46	56	58	55	51	52
Mean.	33.5	36.0	37.4	40.7	44.5	45.2	46.5	48.8	50.5	49.7	55.1	54.0	57.9	58.7	60.8

In Table XX are given
series, also the coldest and
Weather Service. It will
the values in the last two
Table XXI contains a

TABLE XXI.—

Year.
1830 and 1831
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Mean, 1831-1850
Mean, 1851-1870
Mean, 1871-1891
Mean, 1831-1891

TABLE XXII.—*Mean temperature of Chicago bg pentads*—Continued.

Year.	61.	62.	63.	64.	65.	66.	67.	68.	69.	70.	71.	72.	73.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1870	......	49	47	45	38	39	46	42	37	34	25	5	28
1871	42	45	42	38	34	23	22	18	24	26	10	24	23
1872	49	42	44	30	22	34	15	29	22	29	14	4	22
1873	32	40	41	32	29	34	28	33	36	31	30	33	26
1874	44	55	52	44	32	34	24	40	32	34	34	33	27
1875	44	42	44	38	40	34	32	43	36	30	29	40	43
1876	60	44	43	44	42	32	23	27	14	23	19	19	20
1877	48	37	40	48	42	44	26	35	37	46	54	48	39
1878	40	44	45	45	45	39	39	35	33	29	20	8	15
1879	40	35	56	52	33	36	40	44	35	26	21	18	34
1880	45	48	44	29	16	22	27	26	15	35	30	28	1
1881	55	44	45	38	34	29	45	38	33	40	43	38	30
1882	51	47	55	36	40	35	33	26	14	20	32	34	28
1883	48	50	48	25	46	43	38	38	39	30	12	29	29
1884	47	42	48	47	40	30	32	45	35	26	9	4	2
1885	44	46	46	38	44	37	40	28	21	25	33	38	40
1886	52	46	39	39	37	32	27	19	41	28	25	25	14
1887	42	48	41	42	29	38	24	37	36	30	30	18	10
1888	54	52	42	44	32	38	37	35	38	30	25	38	28
1889	46	39	45	39	43	36	25	38	45	42	42	43	35
1890	38	42	41	46	46	39	36	23	30	32	38	28	33
1891	49	41	46	36	28	32	19	36	31	41	35	35	35
Mean	46.1	44.5	45.2	39.8	36.0	34.5	30.8	33.4	31.1	31.2	27.7	26.8	25.5

Table XXIII contains the normal, or the mean of all the daily temperatures from the beginning, that is, the mean of the mean

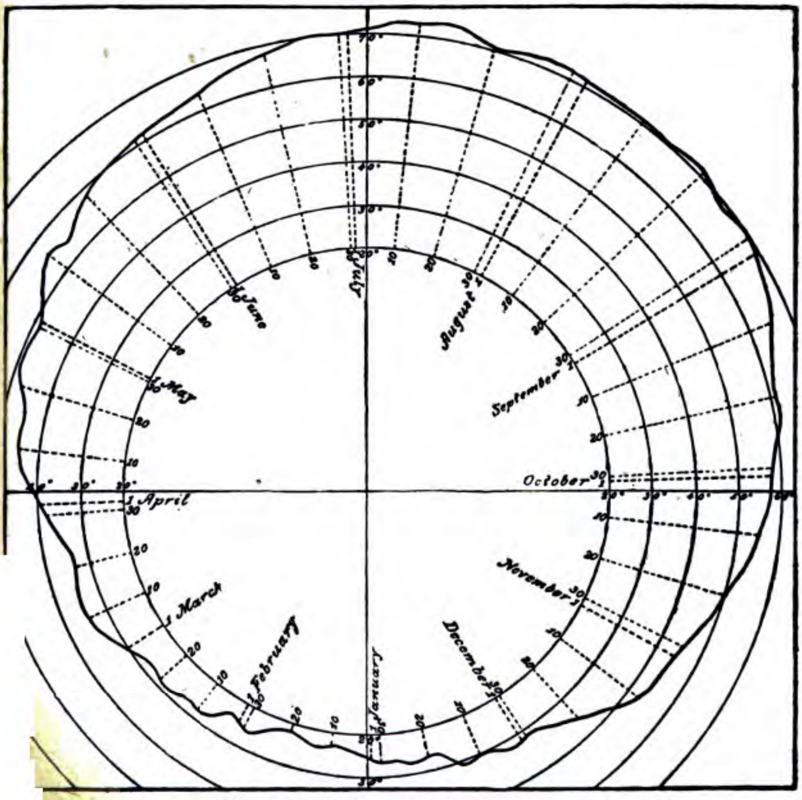


FIG. 11.—*Daily normal temperature.*

daily temperature for January 1 for 20 years is taken as the first mean, for January 2, as the second, and so on. The mean of successive 5 days has been projected in Fig. 11. The mean for the year is 48.6°, and this comes on April 23 and October 24, that is, during 181 days the temperature is below the mean, and for 184 it is above. The highest temperature occurs on July 14, and the lowest January 21, so that for 174 days the temperature is rising and during 191 it is falling. Perhaps the most interesting point in Fig. 11 is the well marked "cold spell" in May. This has been almost universally observed in the northern hemisphere toward the end of the second week, and has received the term "ice saint's days," "May cold spell," etc. The lowest point of the "cold spell" occurs in this record on May 13 and 14. The rise or fall of temperature from the first to the last day in each month is as follows:

February, +5.4°; March, +7.4°; April, +9.0°; May, +12.8°; June, +8.6°; August, —3.2°; September, —11.0°; October, —13.4°; November, —14.2°; December, —4.2°. This shows that the rise in temperature is fastest in May and is a little less than one degree in two days. The fall is about the same in October and November, or about one degree in two days.

TABLE XXIII.—*Daily normal temperatures, Chicago.*

Date.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
[illegible]	[illegible]	23	33	39	47	61	71	73	69	58	45	32
[illegible]	23	24	32	39	49	63	71	72	69	59	44	33
[illegible]	24	26	29	42	51	63	73	72	69	58	44	34
[illegible]	24	24	29	41	52	63	70	72	69	56	45	33
[illegible]	25	24	32	43	52	63	72	71	69	55	44	32
[illegible]	[illegible]	27	33	44	52	62	73	71	70	54	44	32
[illegible]	[illegible]	29	32	43	53	62	74	72	68	57	46	30
[illegible]	[illegible]	26	35	45	55	64	75	72	67	57	45	30
[illegible]	[illegible]	26	35	46	56	62	73	71	66	58	45	29
[illegible]	[illegible]	31	36	43	56	63	71	70	64	55	44	32
[illegible]	23	[illegible]	36	44	56	65	72	72	64	55	44	32
[illegible]	[illegible]	26	34	45	55	65	74	72	65	55	42	33
[illegible]	24	[illegible]	34	46	52	65	72	71	62	54	40	33
[illegible]	23	[illegible]	38	48	53	66	74	70	62	53	39	29
[illegible]	25	[illegible]	38	44	53	68	75	70	64	54	38	28
[illegible]	[illegible]	[illegible]	33	42	56	66	74	70	62	52	39	28
[illegible]	[illegible]	[illegible]	34	45	58	67	72	70	62	52	39	26
[illegible]	[illegible]	[illegible]	35	49	58	69	70	72	62	49	37	26
[illegible]	[illegible]	[illegible]	34	46	61	68	70	73	61	51	35	28
[illegible]	[illegible]	[illegible]	[illegible]	48	59	69	70	72	59	51	36	30
[illegible]	[illegible]	[illegible]	37	48	57	66	70	72	61	51	36	28
[illegible]	[illegible]	[illegible]	34	50	58	68	71	70	61	50	36	29
[illegible]	[illegible]	[illegible]	35	49	58	71	71	69	62	48	34	28
[illegible]	[illegible]	[illegible]	[illegible]	47	62	71	72	69	63	48	32	28
[illegible]	[illegible]	[illegible]	[illegible]	49	59	69	73	70	61	49	34	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61	70	72	70	59	47	35	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61	71	73	71	59	48	33	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	61	69	73	71	58	49	29	25
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69	72	70	59	47	27	28
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	71	74	70	58	45	30	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	......	73	70	......	44	......	29
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	66.3	72.3	71.0	63.5	52.2	38.7	29.5

ACCUMULATED TEMPERATURE.

If we subtract the temperature for each succeeding day and make the algebraic sum with the sum for the preceding days, we shall have what may be called the increase or accumulated change in temperature. Table XXIV exhibits the normal accumulated temperature for the middle and last days of each month.

TABLE XXIV.—*Normal accumulated temperatures.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
15th	−1	3	8	18	27	42	49	44	38	28	12	2
Last	−1	5	14	22	34	45	47	44	32	18	4	3

On making a similar summation for any year we can tell, by comparing with this table, whether there has been an excess or deficiency in the temperature.

HIGHEST AND LOWEST TEMPERATURES.

TABLE XXV.—*Maximum and minimum temperatures for Chicago.*

MAXIMUM.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	°	°	°	°	°	°	°	°	°	°	°	°
1872	......	......	......	......	......	98	97	93	93	81	59	46
1873	51	53	60	83	87	92	93	92	88	75	59	60
1874	60	56	64	67	89	95	99	98	89	78	72	52
1875	44	45	73	72	75	87	88	86	87	73	57	68
1870	65	63	69	70	87	88	93	92	78	73	66	45
1877	56	58	65	78	86	87	91	89	86	80	58	67
1878	49	55	68	75	78	85	97	91	87	79	57	46
1879	49	51	71	80	87	87	93	91	83	84	69	62
1880	61	63	60	80	85	91	95	93	85	78	65	50
1881	41	51	48	77	87	89	93	98	94	77	64	59
1882	58	62	63	76	76	88	90	87	87	77	72	45
1883	40	57	62	78	80	84	91	89	84	78	62	57
1884	49	53	59	77	78	86	89	91	89	83	64	61
1885	50	47	58	76	80	88	94	85	81	69	66	50
1886	48	56	70	81	82	87	94	92	86	79	69	60
1887	52	58	68	82	86	96	100	98	92	82	67	53
1888	44	47	64	83	81	90	94	91	88	76	75	53
1889	55	48	68	73	88	86	90	88	84	79	57	64
1890	62	59	56	75	86	92	93	96	88	73	67	53
1891	54	58	57	75	81	88	87	96	91	86	60	57

MINIMUM.

Years.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1872	......	......	......	......	......	51	52	47	37	27	− 2	− 23
1873	−16	−18	−12	25	35	44	50	53	41	23	8	13
1874	− 6	9	17	22	38	46	60	58	44	30	zero	1
1875	−20	−13	9	17	27	40	56	52	40	30	zero	− 1
1876	4	− 3	10	32	35	47	57	54	37	28	14	− 14
1877	− 4	21	5	27	33	45	57	55	44	35	14	22
1878	− 1	17	25	36	38	50	59	57	43	27	31	− 9
1879	−18	− 6	16	17	39	43	60	52	39	28	16	− 2
1880	19	12	19	27	37	52	57	53	40	28	1	− 15
1881	−13	8	11	17	37	46	57	58	49	41	14	13
1882	1	10	22	25	34	42	55	51	42	40	21	− 7
1883	−17	− 9	10	28	36	48	51	54	42	38	10	zero
1884	−18	− 3	− 1	31	40	47	54	51	51	28	5	11
1885	−13	−14	4	27	34	42	53	55	47	36	28	− 3
1886	−14	− 6	15	23	40	49	55	53	42	32	16	− 10
1887	−15	− 7	9	19	42	48	61	49	38	14	− 1	−
1888	−17	−18	− 1	30	32	43	56	51	36	32	20	
1889	zero	−11	20	29	36	42	54	54	35	35	12	
1890	− 5	3	zero	28	34	52	56	51	39	28	27	
1891	10	− 8	7	23	35	44	55	49	48	33	3	

[illegible]	January		February		[illegible]		[illegible]
[illegible]	18	25	18	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	17	25	8	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	19	30	11	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	23	30	10	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	11	28	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1890	9	21	6	[illegible]	[illegible]	[illegible]	[illegible]
1891	9	25	9	[illegible]	10	[illegible]	[illegible]
Mean...	13.8	26.3	9.4	[illegible]	[illegible]	10.7	[illegible]

Table XXV gives the highest and lowest temperatures observed in each month during which maximum and minimum thermometers were in use. The highest temperature during the 20 years was 99.6°, on July 17, 1887, and the lowest was —23°, December 24, 1872.

Table XXVI shows the number of times during each month that the maximum was below 32° or above 90°, and the minimum below 32°.

Table XXVII gives the dates on which the minimum temperature was —15° or below, at the Weather Service thermometer. We see that this temperature was reached but 16 times in the 20 years, or, we may say, that on the average we can expect such temperature once a year.

TABLE XXVII.—*Dates on which the minimum temperature was* —15° *or below at Chicago from June* 12, 1872, *to December* 31, 1890.

Year.	Date.	Remarks.	Year.	Date.	Remarks.
1872..	Dec. 22, 23, and 24.		1882..	None	Lowest, —7°, Dec. 8.
1873..	Jan. 29; Feb. 23...		1883..	January 21 and 22.	
1874..	None	Lowest, —6°, Jan. 15.	1884..	January 5	
1875..	January 9..........		1885..	None	Lowest, —14°, Feb. 10 and 11.
1876..	None	Lowest, —14°, Dec. 9.			
1877..	...do	Lowest, —4°, Jan. 23.	1886..	...do	Lowest, —14°, Jan. 23.
1878..	...do	Lowest, —9°, Dec 24.	1887..	January 3 and 7 ..	
1879..	January 2 and 3...		1888..	Jan. 16; Feb. 9 ...	
1880..	December 29		1889..	None	Lowest, —11°, Feb. 23.
1881..	None	Lowest, —13°, Jan. 14.	1890..	...do	Lowest, —5°, Jan. 22.

Table XXVIII gives the dates on which the maximum temperature was 90° or over. There are 121 cases in the 19 years, or about 6 each year. 1875 had no case; 1882 and 1884, one each; and 1877 and 1889, two each.

TABLE XXVIII.—*Dates on which the maximum temperature was* 90° *or above at Chicago from June* 12, 1872, *to December* 31, 1890.

Year.	Date.	Year.	Date.	Year.	Date.	Year.	Date.
1872...........	June 18	1874..........	July 6	1879..........	Aug. 2	1886..........	July 28
1872...........	June 19	1874..........	July 7	1880..........	June 11	1886..........	Aug. 21
1872...........	June 20	1874..........	July 14	1880..........	July 10	1887..........	June 16
1872...........	June 27	1874..........	July 19	1880..........	July 11	1887..........	June 17
1872...........	June 28	1874..........	July 25	1880..........	July 12	1887..........	July 12
1872...........	June 30	1874..........	Aug. 11	1880..........	July 13	1887..........	July 15
1872...........	July 1	1874..........	Aug. 17	1880..........	Aug. 18	1887..........	July 16
1872...........	July 2	1874..........	Aug. 19	1881..........	July 5	1887..........	July 17
1872...........	July 9	1874..........	Aug. 20	1881..........	July 7	1887..........	July 27
1872...........	July 15	1874..........	Aug. 21	1881..........	July 8	1887..........	Aug. 3
1872...........	Aug. 6	1875*.........	None.	1881..........	July 9	1887..........	Aug. 9
1872...........	Aug. 7	1876..........	July 6	1881..........	July 12	1887.........	Aug. 10
1872...........	Aug. 8	1876..........	July 7	1881..........	Aug. 3	1887..........	Sept. 6
1872...........	Aug. 9	1876..........	July 8	1881..........	Aug. 4	1888..........	June 20
1872...........	Aug. 20	1876..........	July 9	1881..........	Aug. 11	1888..........	July 3
1872...........	Aug. 21	1876..........	July 17	1881..........	Aug. 12	1888..........	July 6
1872...........	Sept. 5	1876..........	July 19	1881..........	Aug. 30	1888..........	July 30
1872...........	Sept. 6	1876..........	Aug. 23	1881..........	Sept. 5	1888..........	July 31
1873...........	June 19	1877..........	July 8	1881..........	Sept. 6	1888..........	Aug. 3
1873...........	June 23	1877..........	July 15	1882..........	July 27	1889..........	July 8
1873...........	July 16	1878..........	July 16	1883..........	July 2	1889..........	July 9
1873...........	July 17	1878..........	July 17	1883..........	July 3	1890..........	June 28
1873...........	Aug. 22	1878..........	July 20	1883..........	July 4	1890..........	June 29
1873...........	Aug. 24	1878..........	Aug. 8	1883..........	July 22	1890..........	June 30
1873...........	Aug. 31	1879..........	July 3	1884..........	Aug. 19	1890..........	July 7
1874...........	June 8	1879..........	July 10	1885..........	July 8	1890..........	July 14
1874...........	June 22	1879..........	July 11	1885..........	July 19	1890..........	July 29
1874...........	June 23	1879..........	July 14	1885..........	July 20	1890..........	July 30
1874...........	June 27	1879..........	July 15	1885..........	July 28	1890..........	Aug. 2
1874...........	June 28	1879..........	July 16	1886..........	July 6	1890..........	Aug.
1874...........	July 3			1886..........	July 25		

*Highest, 88°, July 15.

COLD WAVES.

A cold wave may be considered as one in which the temperature fall is 18° or more in 24 hours, and the point reached is 34° or below. Table XXIX exhibits all the cases of such cold waves in the 21 years here included. There were 179 in all, or less than 9 per year. The distribution by months was as follows:

January, 58; February, 43; March, 18; April, 6; October, 2; November, 20; December, 32. The latest ever noted was on April 22, 1872, and the earliest, October 10 of the same year.

TABLE XXIX.—*Dates on which the* 7 *or* 8 *a. m. temperature had fallen* 18° *or more in* 24 *hours, and to* 34° *or below.*

Year.	Date.	Year.	Date.	Year.	Date.	Year.	Date.
1870	Nov. 14	1875	Nov. 24	1882	Nov. 24	1887	Jan. 18
1871	Jan. 6	1875	Nov. 29	1882	Dec. 7	1887	Jan. 21
1871	Feb. 9	1875	Dec. 17	1883	Jan. 14	1887	Jan. 26
1871	Feb. 18	1876	Jan. 6	1883	Jan. 18	1887	Feb. 4
1871	Dec. 4	1876	Jan. 10	1883	Jan. 20	1887	Feb. 9
1871	Dec. 8	1876	Jan. 19	1883	Jan. 31	1887	Feb. 12
1871	Dec. 20	1876	Jan. 29	1883	Feb. 1	1887	Feb. 19
1871	Dec. 27	1876	Feb. 2	1883	Feb. 17	1887	Feb. 27
1872	Jan. 23	1876	Feb. 4	1883	Feb. 21	1887	Apr. 4
1872	Feb. 14	1876	Feb. 14	1883	Mar. 7	1887	Nov. 20
1872	Feb. 25	1876	Feb. 22	1883	Mar. 19	1887	Nov. 28
1872	Mar. 15	1876	Dec. 9	1883	Dec. 8	1887	Dec. 5
1872	Mar. 20	1876	Dec. 15	1883	Dec. 15	1887	Dec. 21
1872	Apr. 22	1877	Jan. 8	1883	Dec. 27	1887	Dec. 28
1872	Oct. 10	1877	Jan. 20	1884	Jan. 3	1888	Jan. 11
1872	Nov. 14	1877	Mar. 4	1884	Jan. 20	1888	Jan. 18
1872	Nov. 27	1877	Apr. 2	1884	Jan. 24	1888	Jan. 26
1872	Dec. 9	1878	Jan. 5	1884	Jan. 31	1888	Feb. 6
1872	Dec. 15	1878	Jan. 23	1884	Feb. 14	1888	Feb. 8
1873	Jan. 4	1878	Dec. 23	1884	Feb. 20	1888	Feb. 15
1873	Jan. 17	1879	Jan. 2	1884	Feb. 28	1888	Feb. 20
1873	Feb. 19	1879	Nov. 29	1884	Mar. 12	1888	Feb. 26
1873	Feb. 21	1879	Dec. 11	1884	Nov. 24	1888	Mar. 3
1873	Mar. 3	1880	Jan. 10	1884	Nov. 26	1888	Mar. 11
1873	Mar. 16	1880	Jan. 12	1884	Dec. 31	1888	Mar. 20
1873	Mar. 20	1880	Jan. 31	1885	Jan. 1	1888	Mar. 22
1873	Oct. 28	1880	Feb. 29	1885	Jan. 13	1888	Nov. 16
1873	Dec. 4	1880	Mar. 8	1885	Feb. 10	1889	Jan. 10
1874	Jan. 5	1880	Apr. 11	1885	Feb. 16	1889	Jan. 17
1874	Feb. 9	1880	Nov. 21	1885	Apr. 8	1889	Jan. 21
1874	Mar. 4	1880	Dec. 28	1885	Nov. 13	1889	Feb. 5
1874	Mar. 8	1881	Jan. 7	1885	Dec. 11	1889	Feb. 12
1874	Nov. 18	1881	Jan. 10	1885	Dec. 15	1889	Feb. 23
1874	Nov. 24	1881	Jan. 14	1886	Jan. 10	1889	Dec. 25
1874	Dec. 14	1881	Feb. 28	1886	Jan. 17	1889	Dec. 30
1874	Dec. 29	1881	Dec. 1	1886	Jan. 23	1890	Jan. 6
1875	Jan. 9	1881	Dec. 14	1886	Feb. 20	1890	Jan. 13
1875	Jan. 14	1882	Jan. 9	1886	Feb. 26	1890	Jan. 16
1875	Jan. 22	1882	Jan. 14	1886	Nov. 18	1890	Jan. 20
1875	Jan. 25	1882	Jan. 17	1886	Nov. 24	1890	Jan. 24
1875	Feb. 3	1882	Jan. 22	1886	Dec. 2	1890	Feb. 5
1875	Feb. 4	1882	Jan. 29	1886	Dec. 15	1890	Feb. 8
1875	Mar. 16	1882	Feb. 8	1886	Dec. 27	1890	Mar. 1
1875	Apr. 16	1882	Feb. 17	1887	Jan. 1	1890	Nov. 10
1875	Nov. 21	1882	Feb. 22	1887	Jan. 10		

VARIABILITY OF TEMPERATURE.

the mean temperature for each day from that for and add the differences without regard to signs, and then divide the sum by the number of days in the month, we shall obtain what has been called the "variability" of temperature. This, for each month of 1888–1891, is as follows:

January, 7.1°; February, 8.4°; March, 5.7°; April, 6.7°; May, 6.3°; June, 5.0°; July, 4.4°; August, 3.9°; September, 4.4°; October, 4.3°; November, 5.0°; December, 5.9°.

We see that the variability is much greater during the months of rising than falling temperature, in the ratio 6.5:4.7. This shows a rather mild and favorable condition during the autumn months for Chicago.

It is of interest to compare the variability at a number of stations widely distributed over this country. Table XXX gives these values.

TABLE XXX.—*Variability of temperature from* 1881 *to* 1887.

Station.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
Chicago	8.2	7.1	5.5	5.6	5.5	5.6	4.1	3.3	4.2	4.6	5.4	6.6	5.5
Assinaboine	7.2	6.5	4.7	4.7	4.1	4.0	3.3	3.1	3.8	5.0	4.7	6.5	4.8
Brownsville	6.8	5.2	4.4	3.0	1.9	1.3	1.0	1.4	1.9	2.6	4.7	5.7	3.3
Charleston	6.1	5.7	5.0	3.8	2.7	2.4	1.7	1.9	1.9	3.2	4.7	5.4	3.7
Cincinnati	8.0	7.8	6.7	4.8	4.2	3.5	2.5	2.8	3.5	4.4	6.2	6.4	5.1
Denver	9.2	6.5	6.1	5.1	4.6	3.4	3.5	3.0	4.3	5.5	6.1	7.6	5.4
Key West	2.9	2.3	2.4	1.7	1.3	1.3	1.2	1.3	1.3	1.2	1.8	2.8	1.8
New Orleans	6.2	4.7	3.9	3.1	1.9	1.5	1.6	1.5	1.6	2.4	4.3	5.6	3.2
Omaha	8.6	7.9	6.8	6.4	4.6	3.8	3.6	3.7	4.9	5.4	7.0	7.3	5.8
Saint Vincent	9.2	9.4	7.7	5.5	5.4	4.6	3.4	4.4	5.1	5.4	6.2	8.4	6.2
Salt Lake City	4.2	4.5	3.7	4.5	4.7	3.7	3.3	3.1	4.0	4.2	3.7	3.3	3.9
San Francisco	1.9	2.2	2.1	1.9	2.4	1.8	1.6	1.6	2.4	2.1	1.7	2.0	2.0
Tatoosh	2.5	2.2	1.7	1.5	1.6	1.3	1.2	1.7	1.4	1.5	1.9	2.3	1.7
Washington, D.C.	5.9	6.3	5.4	5.0	4.5	3.8	3.1	2.9	3.8	4.8	5.2	5.5	4.7

The variability is about the same for stations within two hundred miles, since this is dependent upon the storms and cold waves which pass over this region.

HOURLY TEMPERATURE.

Tables XXXI and XXXII give the hourly temperatures observed with a thermograph during 1890 and 1891; also hourly pressures given by a barograph. In Fig. 12 are given what are called "chrono-isotherms," or a delineation of the hourly temperatures according to the months of the year. The relation of the temperature march by months is shown still more strikingly in Fig. 13, in which the mean for each month has been subtracted from the temperature for each hour, and this departure has been charted with the months in combination. The times of sunrise and sunset are given in the dotted lines on the left and right.

Table XXXI.—Mean hourly pressure and temperature for 1890, Chicago.

PRESSURE (base number, 29''+).

h.	[illegible]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Mean
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.247	.229	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.175	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.161	.173	[illegible]	[illegible]	[illegible]	.192	[illegible]	.177	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.229	[illegible]	[illegible]	.232	.221	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.054	[illegible]	[illegible]	[illegible]	.050	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	.100	.102	.106	.111	.117	.126	.130	.129	.130	.129	.122	.115	.104	.091	.084	.080	.080	[illegible]	.090	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	.137	.133	.133	.137	.145	.151	.161	.162	.163	.166	.166	.162	.152	.141	.136	.130	.125	.124	.125	.130	.137	.141	.145	.143
[illegible]	[illegible]	.181	.180	.179	.181	.187	.199	.208	.210	.212	.215	.212	.206	.197	.187	.179	.175	.173	.174	.171	.180	.187	.189	.190	.190
[illegible]	.220	.225	.223	.224	.228	.233	.240	.249	.257	.262	.262	.257	.248	.236	.220	.215	.211	.211	.212	.210	.219	.225	.225	.227	.231
[illegible]	.053	.052	.048	.046	.048	.051	.056	.066	.068	.070	.065	.065	.054	.045	.041	.040	.040	.045	.053	.057	.062	.067	.059	.058	.054
mber	.172	.166	.169	.165	.166	.164	.166	.174	.180	.184	.183	.181	.165	.158	.152	.154	.157	.162	.169	.170	.173	.172	.171	.167	.168
ember.......	.194	.192	.199	.198	.193	.190	.199	.207	.205	.215	.202	.210	.191	.176	.167	.170	.172	.179	.185	.191	.191	.190	.188	.191	.191
Year	.156	.153	.152	.151	.152	.156	.164	.172	.177	.180	.179	.178	.166	.155	.147	.143	.141	.143	.145	.148	.153	.156	.157	.156	.157

TEMPERATURE.

	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
January.........	31.2	30.6	30.2	29.5	29.2	28.6	28.7	28.7	28.9	29.4	30.1	31.4	32.7	34.2	34.5	34.7	34.5	34.3	33.9	33.3	32.6	31.9	31.6	31.4	31.5
February	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
March	28.8	28.1	27.6	27.1	26.6	26.1	25.7	25.4	26.1	27.3	28.9	30.0	30.7	31.7	32.4	32.7	33.1	33.0	32.3	31.3	30.9	30.7	30.0	29.8	29.4
April............	44.9	44.8	44.4	43.8	43.3	42.9	42.6	42.9	43.6	44.5	45.5	46.6	47.4	48.3	49.2	49.1	49.5	48.6	46.8	45.8	45.6	46.0	45.6	45.2	45.7
May.............	50.8	50.3	49.9	49.5	48.8	48.5	48.5	50.1	51.2	52.2	54.6	55.4	54.5	55.4	56.2	56.9	57.5	56.8	56.5	55.2	54.4	53.2	52.4	51.9	52.9
June	68.5	68.2	67.7	67.2	66.7	66.5	66.6	67.9	68.6	69.7	71.4	71.9	72.0	72.1	72.5	72.1	72.5	72.6	72.1	71.2	70.6	70.0	69.7	69.6	69.9
July	71.5	70.8	70.1	69.5	69.2	68.8	68.8	69.6	70.1	71.2	73.8	74.2	74.2	74.7	74.9	75.4	76.0	75.7	75.1	74.2	73.3	72.7	72.2	71.8	72.4
August..........	64.4	64.0	63.6	62.9	62.4	61.7	61.4	62.0	62.8	63.6	65.4	66.2	66.8	67.4	67.6	67.8	68.8	68.6	68.1	66.4	66.2	65.7	65.3	64.8	65.2
September	60.4	59.8	59.2	58.8	58.1	57.6	56.9	57.0	57.8	59.4	61.7	62.5	62.9	63.7	63.8	64.3	64.7	64.6	64.0	63.0	62.6	62.2	61.4	60.8	61.1
October	51.5	50.9	50.6	50.1	49.6	49.4	49.0	49.1	49.3	50.3	52.5	53.0	53.0	53.4	53.3	53.5	53.8	53.6	53.0	52.1	51.9	51.6	51.5	51.1	51.5
November	42.0	41.2	40.5	40.0	39.6	39.0	38.7	37.7	37.8	38.7	41.4	42.7	43.8	45.3	45.7	45.9	45.9	45.7	44.8	43.8	43.7	43.5	43.0	42.7	42.2
December........	31.7	31.5	31.2	31.0	30.5	30.1	30.0	29.5	29.5	30.0	31.8	33.2	34.3	35.5	36.1	36.1	36.2	35.6	34.7	33.8	33.1	32.7	32.3	32.2	32.6
Year	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

TABLE XXXII.—*Mean hourly pressure and temperature for 1891, Chicago.*

PRESSURE (base number, 29.''+).

Months.	24.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
January..........	.152	.153	.156	.153	.145	.145	.149	.156	.160	.164	.163	.153	.131	.117	.115	.122	.129	.136	.146	.157	.165	.166	.167	.165	.149
February	.089	.086	.090	.089	.089	.095	.103	.119	.122	.123	.129	.124	.109	.090	.079	.076	.075	.080	.094	.100	.110	.113	.116	.116	.101
March	.163	.161	.153	.144	.144	.147	.147	.150	.146	.145	.143	.142	.135	.121	.113	.108	.106	.115	.122	.124	.132	.136	.140	.142	.137
April.............	.120	.116	.113	.113	.115	.123	.131	.140	.142	.144	.147	.144	.136	.127	.115	.115	.113	.107	.107	.111	.118	.129	.129	.128	.124
May...............	.220	.218	.219	.222	.226	.235	.249	.260	.263	.262	.265	.259	.248	.237	.225	.212	.205	.200	.197	.200	.205	.215	.216	.215	.228
June	.064	.060	.062	.062	.070	.078	.087	.094	.100	.100	.101	.098	.092	.077	.070	.060	.050	.042	.047	.050	.057	.066	.071	.070	.072
July	.147	.147	.145	.147	.153	.160	.171	.176	.181	.182	.184	.180	.176	.162	.155	.149	.144	.137	.136	.138	.139	.145	.145	.145	.156
August...........	.116	.113	.112	.115	.120	.127	.134	.140	.142	.145	.146	.139	.132	.120	.110	.103	.105	.104	.105	.106	.118	.123	.125	.125	.122
September	.243	.244	.243	.248	.250	.256	.266	.274	.277	.281	.280	.272	.262	.248	.234	.222	.216	.216	.217	.222	.232	.237	.239	.243	.247
October	.224	.224	.219	.218	.220	.223	.228	.234	.232	.235	.233	.228	.213	.200	.195	.192	.192	.197	.206	.215	.220	.223	.224	.221	.217
November	.177	.176	.175	.170	.165	.167	.168	.171	.180	.179	.176	.169	.156	.147	.142	.144	.150	.158	.169	.169	.171	.176	.179	.176	.167
December........	.150	.148	.153	.153	.149	.150	.158	.162	.168	.174	.174	.161	.135	.118	.108	.113	.118	.121	.125	.129	.134	.136	.138	.140	.142
Year	.155	.154	.153	.153	.154	.159	.166	.173	.176	.178	.178	.172	.160	.147	.138	.135	.134	.134	.139	.143	.150	.155	.157	.157	.155

TEMPERATURE.

Months.	24.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January..........	29.8	29.6	29.4	29.3	29.0	28.7	28.5	28.4	28.5	28.9	29.7	30.2	30.8	31.4	31.7	31.7	31.6	31.5	31.0	30.5	30.3	30.0	30.0	29.7	30.0
February	27.9	27.2	26.7	26.2	25.7	25.2	25.0	24.7	25.2	26.6	28.0	29.2	30.5	21.4	32.0	32.6	32.9	32.3	31.3	30.6	30.2	29.8	28.9	28.0	28.7
March	29.3	28.8	28.6	28.2	28.1	27.6	27.6	27.5	28.3	29.5	30.4	31.1	32.1	32.6	32.9	33.0	33.3	33.1	32.5	32.2	31.7	31.3	31.0	30.4	30.5
April.............	45.8	45.6	45.2	44.9	44.1	43.9	43.9	44.5	45.0	45.8	47.3	47.7	47.9	48.7	48.7	49.2	49.5	49.6	48.8	48.0	47.7	47.1	46.7	46.5	46.8
May...............	52.7	52.3	51.5	51.0	50.3	49.8	49.7	50.6	51.3	52.8	53.5	53.8	53.9	54.8	54.8	55.3	55.9	54.8	54.3	53.8	53.8	53.6	53.3	53.1	52.9
June	65.0	64.2	63.9	63.6	63.1	62.7	62.5	63.2	63.6	64.8	65.9	66.5	67.1	67.7	67.6	67.6	67.4	67.0	66.8	66.2	66.2	66.1	65.6	65.1	65.4
July	65.4	64.6	64.0	63.5	62.9	62.7	63.2	64.9	65.9	67.3	68.0	68.4	68.5	68.7	69.0	69.4	69.5	69.3	69.2	68.7	68.1	67.7	67.1	66.4	66.8
August...........	67.1	66.3	65.5	64.8	64.4	64.2	64.7	66.1	68.8	70.0	70.8	71.3	71.8	71.9	72.5	72.8	72.9	72.4	71.5	70.5	69.9	69.2	68.4	67.6	69.0
September	67.4	66.8	66.2	65.6	65.0	64.1	63.5	64.5	66.4	68.9	70.7	71.6	72.6	72.9	73.0	73.2	73.2	72.7	71.8	70.7	69.9	69.5	68.9	68.1	69.0
October	51.3	51.0	50.0	49.4	48.8	48.1	47.5	47.7	49.1	51.0	52.6	53.9	55.3	56.3	57.4	57.9	57.8	57.3	56.0	54.4	53.3	52.4	51.9	51.2	52.6
November	33.4	32.7	31.9	31.3	31.3	31.2	31.1	31.0	31.7	32.6	33.6	34.7	35.5	36.2	36.3	36.5	36.4	36.5	35.9	35.5	35.1	34.7	34.1	33.7	33.9
December........	34.3	33.8	33.3	33.2	32.8	32.5	32.2	32.3	32.5	33.6	35.1	36.1	37.0	38.2	38.8	39.0	38.7	38.2	37.3	36.9	36.6	36.5	36.2	35.7	35.5
Year	47.4	46.9	46.4	45.9	45.5	45.1	45.0	45.4	46.4	47.6	48.8	49.5	50.2	50.9	51.2	51.5	51.6	51.2	50.5	49.8	49.4	49.0	48.5	48.0	48.4

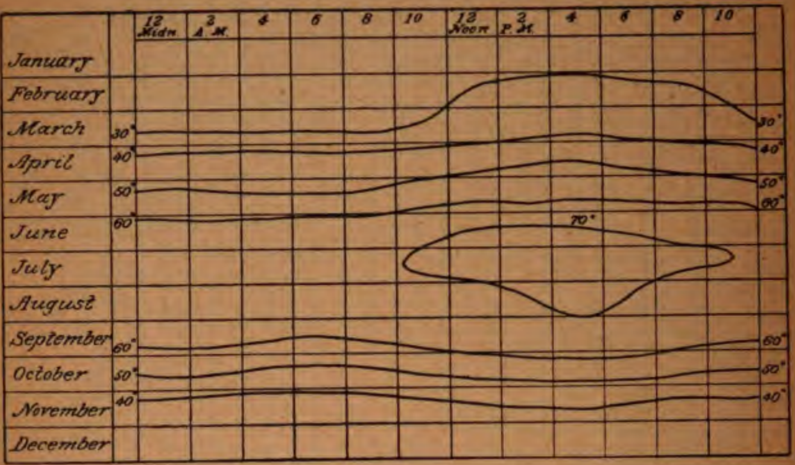
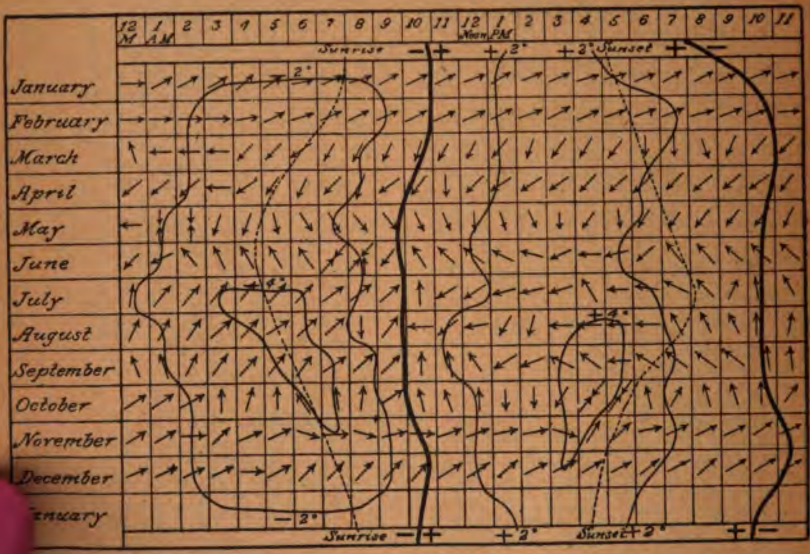


FIG. 12.—*Chrono-isotherms, Chicago,* 1890 *and* 1891.



13.—*Departure of mean temperature for each hour from the mean for the day at Chicago for* 1890.

We see very clearly shown, in Fig. 13, the effect of the lake breezes in keeping down the afternoon temperature. The curve of 4° showing the maximum departure is below August, and quite small. The effect of the lake in moderating extremes of temperature will be shown best by comparing the conditions here with those at other stations situated on the ocean or lakes. Fig. 14 is for Eastport, Me.; Fig. 15, Buf-

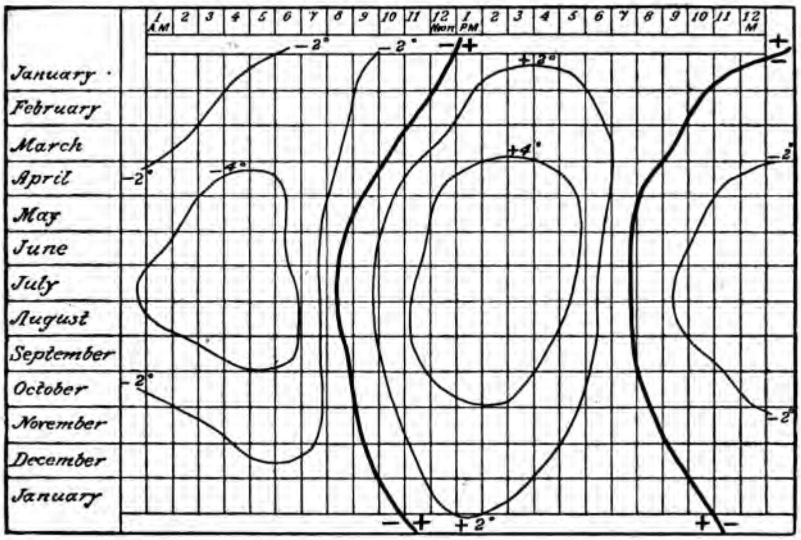


FIG. 14.—*Departure of mean temperature for each hour from the mean for the day at Eastport, Me., for* 1890.

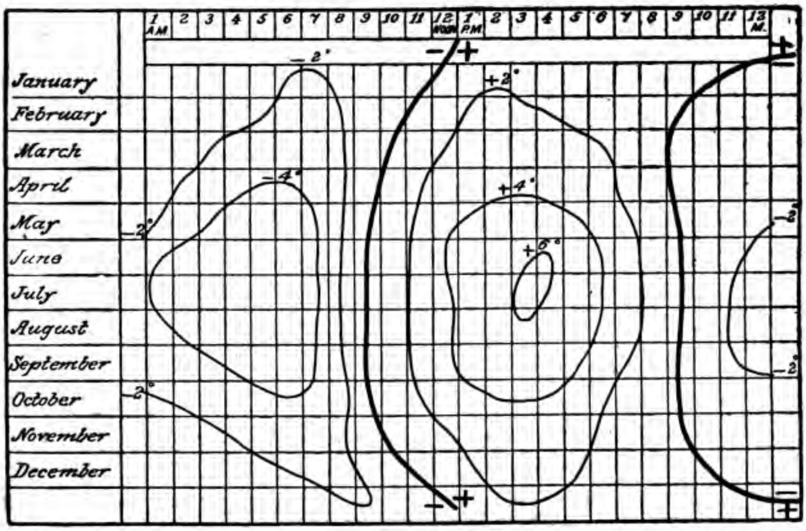


FIG. 15.—*Departure of mean temperature for each hour from the mean for the day a Buffalo, N. Y., for* 1890.

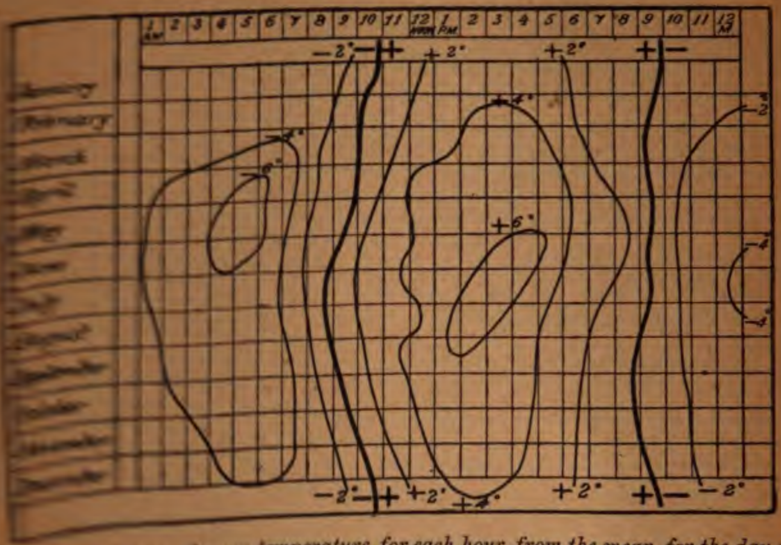
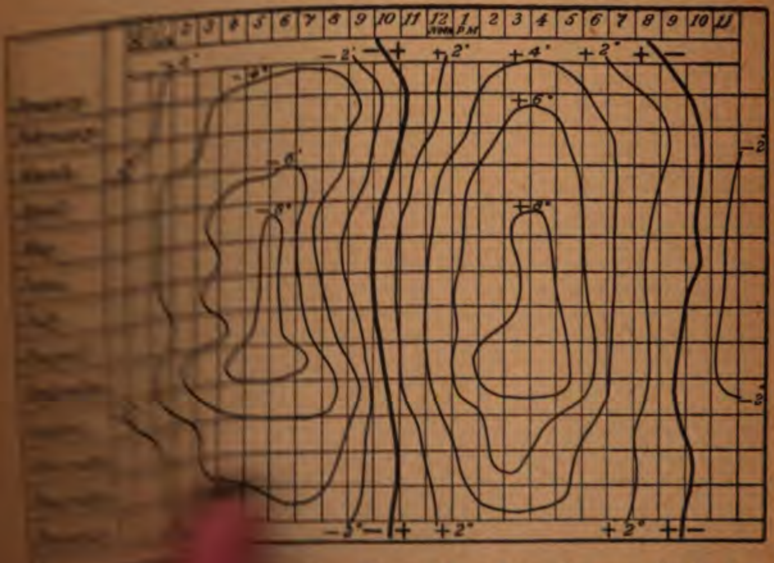


Fig. [illegible].—Departure of mean temperature for each hour from the mean for the day at Boston, Mass., for 1890.



[illegible] perature for each hour from the mean for the day at [illegible] int Louis, Mo., for 1890.

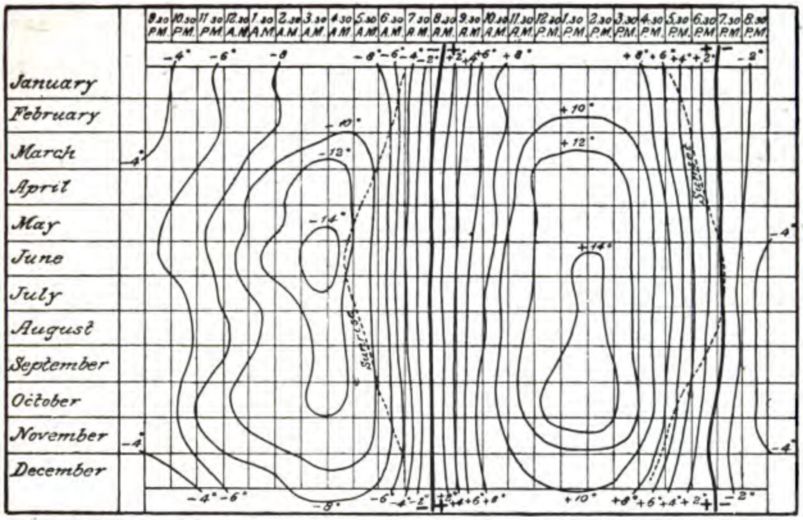


FIG. 18.—*Departure of mean temperature for each hour from the mean for the day at Yuma, Ariz., for* 1890.

falo, N. Y.; Fig. 16, Boston, Mass.; Fig. 17, Saint Louis, Mo.; and, by contrast, Fig. 18 is given for Yuma, Ariz. It will be seen that at all these stations the range from the lowest morning temperature to the highest in the afternoon is less for Chicago than for any other. The extreme range of about 29° at Yuma and about 11° at Buffalo corresponds to one of only 8° at this station.

PRECIPITATION AT CHICAGO.

Consistent records of rain and snow fall can scarcely be said to begin at Chicago before January, 1867. Prior to that date observations of this element were taken, and, in some cases, records were kept for one or more months, but never for a whole year. The cases in which monthly values have been preserved are the following:

1844, March and April; 1856, November and December; 1857, January to June, inclusive; and 1862, October.

Beginning with January, 1867, observations were taken by several observers reporting to the Smithsonian Institution. This series, which may be distinguished as the Voluntary Observers' period, was maintained without interruption to and including August, 1871; resumed in February, 1872, it was continued through December, 1874, with the single exception of March of the latter year.

Examining the overlapping period of the two systems of records, the differences shown in Table XXXIII are found; in this the Weather Service has been considered the standard record, and the amount of divergence of the Voluntary Observers' record is give with the sign appropriate to its direction.

TABLE XXXIII.—*Difference between Weather Service and Voluntary Observers' record.*

Year.	January.	February.	March.	April.	May.	June.	July.
1871	+4.64	+0.77	−0.82	−0.35	+0.31	+0.03	−0.36
1872	....	−0.15	−2.10	+0.08	+0.04	−0.04	+0.05
1873	+0.03	−0.06	+0.48	−3.12	+1.90	+0.36	−0.09
1874	+2.93	+1.80	....	−1.88	−1.06	+3.95	+1.12

Year.	August.	September.	October.	November.	December.	Annual.
1871	....	....	....	....	....	....
1872	−0.10	+0.61	0.00	+0.19	+1.38	+2.15
1873	+0.22	−0.13	−1.13	+0.89	−1.54	−2.19
1874	−1.45	−0.46	−1.85	−0.03	−0.63	....

Combination of these two systems gives for Chicago a period of 24 years during which observations have been directed upon the precipitation. Any attempt, such as the present, to arrive at an estimate of the precipitation in the period prior to the beginning of observation, must depend on the character and extent of the records maintained at stations sufficiently near to be considered typical of the same climatic district, and at the same time overlapping the existing records of the place under examination to such an extent as will admit of establishing, at least approximately, a ratio of variation.

It should be noted that these values for precipitation in Table XXXIV can not be considered entirely satisfactory, not only because of the difficulty of extrapolating the values, but also because the rain gauges have not always had a good exposure. A correct value of the precipitation for this station is still a great desideratum.

The rainfall by lustra, or 5-year periods, is as follows: 1871–1875, 33.56 inches; 1876–1880, 37.59 inches; 1881–1885, 42.07 inches; 1886–1890, 30.88 inches.

HEAVY PRECIPITATION.

In order to obtain an idea of the number of heavy rains that have fallen, Table XXXV has been prepared, which gives the dates on which a precipitation of .75 inch or more occurred in 8, or, since July, 1888, in 12 hours. There are 167 cases in the 20 years, or about 8 per year. The distribution by months is as follows:

January	3	August	19
February	5	September	17
March	8	October	19
April	14	November	6
May	20	December	5
June	21		
July	30	Total	167

TABLE XXXIV.—*Precipitation from* 1843 *to* 1891, *Chicago.*

(All observed values are given to hundredths.)

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
1843	2.0	1.9	3.0	4.5	4.0	4.6	1.4	2.4	3.0	1.2	5.1	2.4	35.50
1844	2.8	1.3	1.76	2.76	6.0	5.5	5.0	4.2	0.8	1.6	0.7	0.7	33.12
1845	2.0	0.5	2.2	6.5	2.0	3.8	3.5	1.2	4.4	1.4	3.3	1.5	32.30
1846	4.9	1.8	2.6	7.8	2.4	4.3	2.9	1.0	5.0	0.8	1.5	5.0	40.00
1847	2.3	3.5	1.5	2.1	3.3	1.5	2.8	2.0	3.2	4.6	4.8	1.2	32.80
1848	1.6	2.4	4.5	3.3	3.8	4.4	3.4	5.1	2.2	3.2	2.1	8.4	44.40
1849	5.5	1.0	4.7	1.8	3.8	3.6	2.3	3.5	2.6	2.8	1.4	1.2	34.20
1850	2.1	0.7	2.0	3.8	1.9	3.1	2.1	6.4	1.4	2.0	3.2	1.7	30.40
1851	1.5	3.8	0.8	4.2	6.7	5.3	3.8	3.1	3.2	2.3	2.3	1.6	38.60
1852	2.0	1.2	5.5	4.8	2.4	2.5	3.4	0.6	2.3	6.8	4.0	3.3	38.80
1853	1.4	2.2	1.8	2.8	4.4	4.9	6.1	2.2	4.2	2.0	2.1	2.3	36.40
1854	1.3	1.9	2.1	2.1	3.1	2.6	3.0	0.9	1.6	3.6	1.0	1.4	24.60
1855	8.0	0.6	2.6	1.4	2.5	3.7	5.8	3.2	2.3	2.0	2.2	2.0	36.30
1856	0.9	1.8	0.6	2.6	4.8	2.5	2.1	1.3	2.5	2.1	3.98	3.86	29.04
1857	1.09	5.43	2.55	2.19	6.33	4.14	3.0	5.0	2.2	4.0	2.7	1.2	39.83
1858	1.3	1.4	3.0	3.1	7.8	6.3	5.9	3.2	4.0	4.6	4.5	2.0	47.10
1859	1.4	1.8	5.2	3.4	3.6	1.7	0.9	0.4	2.2	4.1	2.8	1.8	29.30
1860	1.6	1.6	1.0	2.8	4.6	3.5	5.3	2.6	2.8	4.1	2.3	4.2	36.40
1861	1.4	3.0	3.4	4.7	3.7	2.1	4.3	2.4	3.4	7.5	1.5	1.9	39.30
1862	4.0	0.7	2.0	5.2	4.3	2.9	6.7	3.6	5.6	2.92	1.2	1.3	40.42
1863	2.8	2.6	2.1	2.1	5.1	1.3	2.3	4.2	1.6	4.0	1.9	3.6	33.60
1864	1.6	0.4	2.1	3.2	1.9	2.1	6.4	1.1	2.1	1.9	3.1	2.5	28.40
1865	0.4	3.1	3.1	3.8	1.5	5.1	6.1	7.2	4.8	4.0	0.5	0.6	40.20
1866	2.8	1.6	2.2	2.8	2.0	4.4	4.7	4.2	4.6	2.8	0.8	3.4	36.30
1867	1.93	2.22	1.58	1.70	4.42	1.86	1.52	2.33	0.57	1.28	1.89	1.11	22.41
1868	1.28	0.92	5.24	3.00	3.74	3.11	2.87	3.55	7.08	1.69	2.60	1.40	36.48
1869	1.97	2.23	1.33	4.30	5.69	5.03	3.26	1.32	0.89	1.10	2.42	2.03	31.57
1870	1.95	0.86	1.81	1.15	0.80	1.70	3.71	2.07	2.82	2.43	1.16	2.46	22.92
1871	4.13	1.45	2.66	3.79	3.90	5.56	2.52	2.01	0.74	1.88	3.62	3.44	35.61
1872	0.68	0.84	3.79	3.03	3.24	3.45	3.09	2.59	6.43	0.65	1.06	0.22	29.07
1873	2.56	0.47	0.89	6.22	7.20	1.44	4.04	1.58	3.53	2.43	1.61	4.44	36.41
1874	3.47	1.51	2.15	2.67	2.08	3.25	0.58	3.15	3.76	2.55	2.83	0.63	28.63
1875	0.96	1.99	1.43	2.32	3.64	5.17	7.18	3.28	4.39	4.32	0.75	2.62	38.06
1876	3.22	3.90	4.04	2.07	1.85	5.96	3.11	3.66	3.74	1.20	3.25	0.48	36.48
1877	1.91	0.06	5.37	2.42	1.81	6.04	2.98	3.06	2.02	6.51	6.08	2.75	41.01
1878	1.31	2.12	4.39	5.57	5.22	3.02	6.09	3.66	1.99	5.17	0.83	2.58	41.95
1879	0.54	1.47	2.37	1.93	3.89	3.18	5.58	0.45	1.18	2.72	4.93	2.47	30.71
1880	3.53	2.91	2.25	5.20	4.97	3.50	3.07	4.47	2.25	3.19	0.87	1.11	37.32
1881	0.87	5.98	2.99	1.84	1.85	5.93	4.31	0.54	4.34	6.89	5.97	2.67	44.18
1882	1.55	2.24	3.43	6.72	5.52	5.71	3.43	4.96	0.91	3.40	1.48	1.99	41.34
1883	1.74	4.74	0.42	3.72	7.32	5.61	5.53	1.21	1.36	7.36	5.26	1.59	45.86
1884	1.39	3.27	5.16	3.05	1.53	2.11	3.71	2.50	2.29	3.59	1.80	4.21	34.61
1885	3.18	2.01	0.57	4.00	3.17	5.20	2.44	11.28	2.97	3.87	2.33	3.35	44.37
1886	3.56	1.51	1.79	1.29	1.00	0.94	1.53	3.38	6.93	1.42	1.66	1.76	26.77
1887	3.13	5.10	0.89	0.46	1.38	1.63	1.05	3.35	4.03	2.03	2.41	3.67	29.13
1888	1.56	1.51	2.99	2.13	6.22	1.66	3.93	2.10	0.98	2.95	2.89	1.94	30.86
1889	1.64	1.31	1.43	2.35	5.38	2.93	9.56	0.39	2.75	1.82	3.49	1.90	34.95
1890	2.98	2.42	2.10	3.23	5.13	3.25	2.57	2.58	1.39	4.20	1.59	1.25	32.69
1891	1.99	1.95	2.13	3.14	2.09	2.42	2.47	4.52	0.32	0.36	3.83	1.32	26.54
Mean, 1843 to 1866.	2.36	1.93	2.60	3.49	3.83	3.58	3.88	2.96	3.00	3.18	2.46	2.46	35.72
Mean, 1867 to 1891.	2.12	2.20	2.52	3.09	3.72	3.59	3.57	2.96	2.77	3.00	2.66	2.13	34.40
Mean, 1843 to 1891.	2.24	2.07	2.56	3.29	3.77	3.58	3.72	2.96	2.89	3.09	2.56	2.29	35.06

TABLE XXXV.—*Dates on which .75 inch or more precipitation occurred in 8 or 12 hours.*

Year.	Date.	Year.	Date.	Year.	Date.	Year.	Date.
1871	June 17	1876	June 16	1881	July 21	1885	July 9
1871	July 4	1876	July 10	1881	Sept. 24	1885	Aug. 2
1872	Mar. 30	1876	Aug. 24	1881	Oct. 11	1885	Aug. 23
1872	May 22	1876	Aug. 30	1881	Oct. 14	1885	Aug. 24
1872	May 29	1876	Sept. 13	1881	Nov. 11	1885	Sept. 8
1872	June 6	1877	June 8	1881	Dec. 21	1885	Oct. 19
1872	June 13	1877	June 25	1882	Feb. 28	1885	Nov. 5
1772	July 20	1877	July 2	1882	Apr. 5	1885	Dec. 8
1872	Aug. 28	1877	Aug. 14	1882	Apr. 9	1886	Aug. 16
1872	Sept. 12	1877	Sept. 26	1882	Apr. 23	1886	Sept. 9
1872	Sept. 28	1877	Oct. 3	1882	Apr. 26	1886	Sept. 18
1873	April 11	1877	Oct. 19	1882	May 6	1886	Sept. 19
1873	May 1	1877	Nov. 8	1882	May 27	1887	Jan. 22
1873	May 9	1878	Mar. 28	1882	June 3	1887	Feb. 17
1873	July 4	1878	May 18	1882	June 30	1887	Aug. 11
1873	Sept. 28	1878	May 29	1882	July 31	1887	Aug. 14
1873	Oct. 4	1878	July 26	1882	Aug. 1	1888	May 27
1873	Dec. 3	1878	Aug. 18	1882	Aug. 23	1888	May 28
1873	Dec. 11	1878	Aug. 25	1882	Oct. 8	1888	July 4
1873	Dec. 12	1878	Sept. 25	1883	Feb. 16	1888	July 9
1874	Mar. 3	1879	Mar. 6	1883	Apr. 5	1888	July 31
1874	Apr. 20	1879	Apr. 9	1883	May 9	1889	May 13
1874	June 7	1879	May 25	1883	May 10	1889	May 27
1874	June 8	1879	June 21	1883	June 18	1889	July 3
1874	Aug. 21	1879	July 6	1883	July 4	1889	July 14
1874	Sept. 4	1879	July 7	1883	July 21	1889	July 19
1874	Oct. 28	1879	July 9	1883	July 23	1889	July 27
1875	May 1	1879	July 21	1883	Aug. 27	1889	July 28
1875	June 1	1879	Oct. 17	1883	Oct. 2	1889	Sept. 4
1875	June 21	1879	Nov. 28	1883	Oct. 25	1889	Sept. 5
1875	July 5	1880	Mar. 27	1883	Oct. 29	1889	Oct. 12
1875	July 6	1880	Apr. 16	1883	Nov. 5	1890	Apr. 13
1875	July 27	1880	Apr. 24	1884	Mar. 25	1890	May 10
1875	Aug. 15	1880	May 8	1884	Apr. 15	1890	June 3
1875	Sept. 9	1880	May 10	1884	July 24	1890	June 11
1875	Oct. 29	1880	July 8	1884	Aug. 28	1890	July 14
1876	Jan. 18	1880	Oct. 1	1884	Sept. 27	1890	Aug. 21
1876	Feb. 9	1880	Oct. 3	1884	Oct. 8	1890	Sept. 8
1876	Mar. 16	1881	Feb. 7	1885	Jan. 6	1890	Oct. 6
1876	Apr. 13	1881	Mar. 19	1885	Apr. 17	1890	Oct. 26
1876	June 1	1881	June 7	1885	May 29	1890	Nov. 17
1876	June 8	1881	June 13	1885	June 2		

To obtain an idea of the cases of precipitation of 2.50 inches or more in 24 hours, Table XXXVI has been prepared. This shows 15 cases in 20 years, by months:

January	0	July	3
February	0	August	2
March	1	September	2
April	0	October	1
May	2	November	2
June	1	December	1

These figures show that the heavier rain comes with the local nder showers of the warmer months. There is no contradiction is, with the fact that we have less rain with the lake wind in r, as has already been shown, for with these local storms the rom the west.

TABLE XXXVI.—*Dates on which* 2.50 *inches or more precipitation occurred in* 24 *hours at Chicago to December*, 1890, *inclusive.*

Year.	Date.	Year.	Date.	Year.	Date.	Year.	Date.
1871	Dec. 22	1875	Sept. 10	1879	July 7	1885	June 1
1871	Dec. 23	1877	Oct. 19	1881	Nov. 11	1885	June 2
1872	Sept. 28	1877	Oct. 20	1881	Nov. 12	1885	Aug. 2
1872	Sept. 29	1878	July 25	1883	Nov. 5	1885	Aug. 3
1873	May 1	1878	July 26	1883	Nov. 6	1885	Aug. 23
1873	May 2	1879	May 25	1884	Mar. 25	1885	Aug. 24
1875	Sept. 9	1879	July 6	1884	Mar. 26	1889	July 27

WIND VELOCITY.

The exposure of anemometers has been so frequently changed that it will be very difficult to compare the earlier records, with the anemometer relatively near the ground, with the later records. Table XXXVII gives the total movement for each month during 19 years. Table XXXVIII gives the hourly wind movement for the years 1889, 1890, and 1891. After February, 1890, these records were made on the Auditorium tower. Fig. 19 is a graphic presentation of these figures.

TABLE XXXVII.—*Total wind movement, in miles, for Chicago.*

	January.	February.	March.	April.	May.	June.	July.	August.	Sept.	October.	November.	December.	Annual.
	10,529	7,980	10,938	7,706	8,555	5,423	5,908	4,455	6,720	6,520	5,520	6,799	87,053
	7,135	5,520	7,724	7,507	7,102	6,187	6,689	6,729	5,982	6,246	7,049	7,341	81,211
	5,873	6,590	7,926	7,042	6,310	6,034	5,072	6,234	5,739	7,669	6,585	7,014	78,088
	6,732	5,860	6,736	6,389	6,297	5,494	5,023	4,154	4,885	6,272	5,340	5,903	69,085
7	6,668	6,531	7,737	6,820	6,201	5,832	5,277	4,855	5,600	6,845	6,747	6,896	76,009
878	7,008	6,202	7,182	6,414	5,093	4,607	4,541	4,599	5,220	6,670	4,847	5,284	67,667
1879	4,999	5,106	5,440	5,668	5,434	5,132	4,586	4,762	4,895	4,625	5,354	6,154	62,155
1880	5,232	6,053	6,823	8,214	6,141	5,094	5,028	5,726	6,046	6,902	6,614	6,319	74,192
1881	5,358	5,723	5,774	5,083	5,568	5,768	4,862	5,501	5,906	5,768	7,619	6,606	69,536
1882	6,926	6,625	7,778	7,275	7,232	5,916	5,573	4,997	5,695	5,733	6,095	6,377	76,222
1883	7,140	5,789	6,704	7,328	6,705	5,972	5,901	4,508	4,783	5,925	6,440	5,945	74,140
1884	6,713	5,412	6,168	6,364	6,016	4,496	4,293	4,996	5,800	5,745	5,441	6,574	68,018
1885	7,316	4,934	5,493	6,292	5,406	4,649	4,233	6,092	5,726	6,136	6,185	6,700	69,162
1886	7,498	6,895	6,854	6,148	5,752	4,932	5,472	5,432	5,543	5,568	6,924	5,111	72,129
1887	9,248	7,463	8,271	8,786	6,915	6,463	7,161	6,579	7,849	9,025	9,192	2,959?	89,911
1888	8,294	7,702	8,931	9,112	7,507	7,383	6,450	7,730	6,670	8,210	7,404	8,360	93,753
1889	7,807	7,394	7,985	7,936	9,771	5,614	5,979	5,290	5,609	7,096	7,488	7,664	85,633
1890	7,978	12,105	13,806	14,912	13,538	9,225	11,503	10,297	12,436	10,751	12,224	13,582	142,357
1891	11,142	13,357	14,319	12,043	11,865	9,961	9,670	9,228	10,184	12,899	14,425	15,935	145,028

TABLE XXXVIII.—*Hourly wind movement, in miles, for Chicago.*

Months.	24.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
1889.																									
January	9.8	9.2	9.4	9.6	9.6	10.2	10.3	10.0	10.0	10.0	10.7	10.3	11.0	11.3	11.3	11.5	11.5	11.1	11.0	10.2	9.3	9.6	9.5	9.5	10.2
February	11.3	9.4	9.1	8.4	8.8	9.1	9.3	8.9	9.6	10.2	10.5	10.9	12.4	12.6	13.2	13.1	12.8	12.3	12.7	11.6	11.8	11.4	11.2	11.2	10.9
March	9.9	9.4	9.2	9.7	9.1	9.2	10.0	10.1	10.6	11.0	11.1	11.5	12.4	12.0	12.5	13.0	12.7	12.1	12.0	10.1	9.6	9.6	9.7	9.6	10.7
April	10.1	10.1	10.4	10.8	11.2	10.3	11.3	11.4	11.4	12.1	12.1	12.2	12.3	12.2	12.2	11.9	11.7	11.2	11.2	10.2	9.7	9.8	9.5	9.1	11.0
May	12.3	11.9	12.1	12.0	12.2	11.5	13.1	13.1	13.6	13.8	14.5	15.2	15.4	15.8	15.5	15.0	14.9	14.3	13.9	12.0	10.5	10.4	11.0	11.5	13.1
June	6.7	6.4	6.2	5.9	6.4	6.6	7.4	7.4	8.0	8.2	8.9	9.7	9.7	9.7	10.1	9.8	9.8	9.4	9.3	6.9	6.4	6.1	5.9	6.3	7.8
July	7.5	6.7	6.4	6.0	6.1	5.9	6.0	6.7	7.5	8.1	8.8	9.3	9.2	10.1	10.7	10.5	10.1	10.5	10.3	8.3	7.5	7.0	6.7	7.0	8.0
August	6.3	5.7	5.4	5.3	5.4	5.6	6.4	6.7	6.9	7.3	8.0	8.9	8.9	8.9	8.8	8.5	8.6	8.1	7.7	7.0	6.8	6.6	6.4	6.3	7.1
September	7.5	7.1	7.4	7.1	6.9	7.2	7.7	7.0	7.7	7.4	8.6	8.9	8.6	8.8	8.9	9.1	9.1	8.8	7.7	6.7	7.0	7.0	7.1	7.4	7.8
October	10.5	8.9	8.5	7.5	7.4	7.0	8.5	8.6	9.2	9.1	9.9	10.3	10.5	10.6	10.5	10.6	10.4	10.0	10.1	9.4	10.4	10.1	10.5	10.5	9.5
November	10.0	9.3	9.0	9.0	8.9	9.5	10.4	10.2	11.0	11.1	11.6	11.8	11.7	11.7	11.6	11.3	10.8	11.0	10.9	9.6	9.9	9.6	9.8	9.7	10.4
December	10.2	10.6	9.9	9.7	10.3	10.1	10.7	10.3	10.7	11.5	11.5	10.5	10.6	10.5	10.9	10.5	10.5	9.6	10.4	9.4	9.6	10.1	9.6	9.6	10.3
Year	9.3	8.7	8.6	8.4	8.5	8.5	9.3	9.2	9.7	10.0	10.5	10.8	11.1	11.2	11.4	11.2	11.1	10.7	10.6	9.3	9.0	8.9	8.9	9.0	9.7

TABLE XXXVIII.—*Hourly wind movement, in miles, for Chicago*—Continued.

Months.	24.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean.
1890.																									
January.........	11.0	10.3	10.1	10.3	9.6	9.9	11.0	10.9	10.6	10.9	11.2	11.3	11.2	10.9	11.5	11.4	10.8	10.8	11.7	16.9	10.4	10.2	10.0	10.3	10.7
February.	18.0	17.5	17.0	17.4	17.6	17.1	17.8	17.8	18.5	18.0	18.0	18.3	19.4	19.2	19.9	18.2	18.1	17.3	18.0	16.8	17.8	18.2	18.6	18.2	18.0
March	19.1	18.7	18.8	19.0	17.9	17.9	20.3	18.5	18.8	19.2	19.0	19.1	19.7	19.0	20.5	20.2	19.4	18.9	19.5	16.6	16.3	15.7	15.8	17.5	18.6
April.	21.3	19.8	20.5	20.4	21.2	21.6	22.1	20.1	19.8	19.5	19.7	20.1	19.9	20.4	21.4	21.4	21.5	20.9	21.5	19.8	20.6	21.0	20.9	21.8	20.7
May.............	19.2	17.4	17.5	17.7	18.2	18.1	18.2	17.0	16.3	17.7	18.8	19.8	19.8	20.0	20.5	20.5	19.2	18.7	18.6	15.2	15.6	17.0	17.6	17.9	18.2
June	12.3	12.7	12.2	11.9	11.3	12.4	12.6	11.5	11.8	11.3	12.5	13.6	14.2	14.4	15.2	16.4	15.6	15.0	13.7	11.3	10.6	11.4	12.0	11.6	12.8
July	16.7	16.7	16.6	16.1	15.9	15.8	16.4	14.7	13.6	13.9	13.7	14.3	14.8	15.4	16.6	16.8	16.7	17.0	16.5	14.7	13.7	14.3	14.5	15.3	15.4
August.	15.5	13.6	13.3	13.4	13.7	14.0	14.9	12.8	12.2	13.0	12.9	13.3	13.7	14.0	14.4	15.2	15.7	14.8	14.6	13.2	14.1	13.0	13.3	13.6	13.8
September	19.4	17.9	17.1	16.8	17.4	17.0	18.6	16.9	17.1	17.1	17.5	16.8	16.5	16.4	17.6	18.1	17.3	16.0	16.6	15.1	17.8	18.1	17.8	17.8	17.3
October	15.1	14.6	14.4	14.0	13.7	14.3	14.6	13.6	14.4	14.5	14.5	15.5	15.9	16.9	16.2	15.2	14.4	13.3	14.0	13.5	13.5	13.4	13.7	14.0	14.5
November	17.7	16.7	16.8	16.5	16.6	16.7	17.8	16.7	17.5	17.3	17.5	17.5	18.0	17.8	18.2	18.0	17.3	16.3	16.6	15.5	15.4	15.9	16.5	16.8	17.0
December	18.6	17.3	16.6	16.8	16.5	17.4	18.2	17.2	17.3	17.1	17.8	18.7	18.5	18.4	19.4	19.5	19.8	19.4	20.1	19.1	19.3	18.8	18.0	18.3	18.3
Year	17.0	16.1	15.9	15.9	15.8	16.0	16.9	15.6	15.6	15.8	16.1	16.5	16.8	16.9	17.6	17.6	17.2	16.5	16.8	15.1	15.4	15.6	15.7	16.1	16.3
1891.																									
January.........	15.5	14.5	13.8	13.9	14.3	14.7	14.9	14.1	15.0	15.5	15.6	15.9	15.6	16.1	16.3	16.1	15.5	15.7	15.1	13.9	14.0	14.2	14.3	15.1	15.0
February.	20.9	19.2	18.5	18.2	18.5	19.0	20.4	18.8	19.6	20.2	19.9	20.9	20.8	20.1	20.5	20.7	20.4	21.3	21.4	19.8	19.6	19.1	19.3	19.8	19.9
March	19.5	17.6	17.6	17.6	17.4	18.5	19.5	18.9	19.0	19.2	19.5	18.6	19.7	19.5	19.1	19.7	19.6	20.5	20.0	19.6	20.6	20.5	20.5	19.9	19.2
April............	18.1	16.0	16.7	16.0	16.4	16.6	17.4	15.7	15.6	16.1	16.4	17.2	17.6	17.6	18.7	18.8	18.5	17.9	17.1	15.7	16.1	14.9	14.6	15.8	16.7
May	17.0	15.8	16.5	16.4	17.5	17.6	17.2	15.1	14.7	15.0	15.4	15.6	16.2	15.4	15.5	15.6	16.4	17.3	17.1	15.2	14.6	15.1	15.0	15.7	15.9
June	14.6	14.3	13.2	13.7	13.9	13.6	14.0	13.6	13.3	13.0	13.4	14.1	13.7	13.1	13.9	14.5	14.6	14.8	15.6	13.8	13.6	13.3	13.3	13.3	13.8
July	14.0	12.6	12.6	11.4	12.2	13.4	14.6	12.8	12.6	13.3	14.2	15.5	16.4	14.9	14.2	13.5	13.8	12.8	12.9	11.1	10.8	9.9	10.3	12.1	13.0
August..........	14.0	13.8	14.2	13.1	12.1	12.3	12.6	10.5	9.9	10.0	10.8	11.7	12.1	12.6	13.6	13.3	12.9	12.5	12.4	11.2	11.6	12.5	12.9	14.1	12.4
September	14.5	14.0	15.1	14.8	14.9	14.7	15.4	13.8	12.5	11.5	11.9	13.8	14.9	15.2	15.9	16.1	15.5	14.1	13.1	13.1	12.9	13.9	14.3	13.9	14.1
October.........	17.2	17.2	17.6	16.9	16.3	16.3	17.6	17.4	17.4	17.6	17.5	18.1	19.1	19.0	18.8	18.6	17.4	16.5	16.2	16.0	16.2	16.6	17.2	17.5	17.3
November	21.2	20.3	20.4	21.4	20.9	20.9	21.8	20.0	20.1	20.4	20.6	20.8	20.8	19.9	19.9	19.1	19.0	18.5	18.9	18.1	18.4	19.3	19.6	20.5	20.0
December.......	22.8	21.4	21.9	20.8	20.7	29.1	21.6	19.9	20.3	20.6	21.7	22.8	22.9	22.2	22.6	20.9	20.8	29.4	21.6	20.2	21.7	21.7	22.3	22.1	21.4
Year	17.4	16.4	16.5	16.2	16.3	16.5	17.2	15.9	15.8	16.0	16.4	17.7	17.5	17.1	17.4	17.2	17.0	16.9	16.8	15.6	15.8	15.9	16.1	16.6	16.6

In 1889 we find the appearance of the diurnal range of wind velocity that has been noted generally at other stations, though there is a slight maximum cropping out at midnight and 6 a. m. The curves for 1890 and 1891 have two remarkable maxima besides the

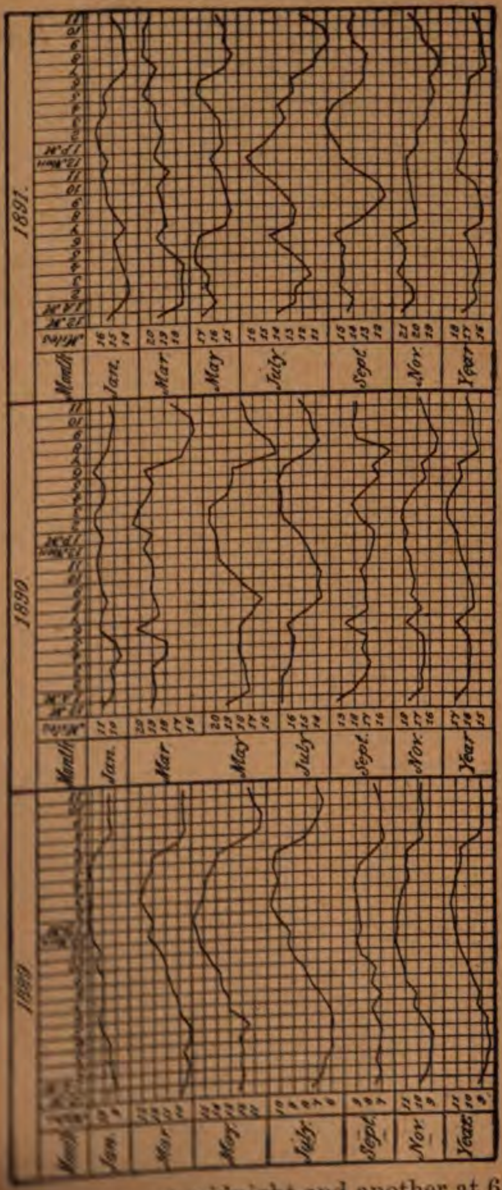


FIG. 19.—*Hourly wind velocity, Chicago.*

[illegible] at 2 p. m., one at midnight and another at 6 a. m. There is [illegible] explaining these secondary maxima rising in 1891 [illegible] height as the principal maximum. We need a [illegible] records, and, above all, at different heights above the lake surface. A morning maximum was found by Professor Harrington at Death Valley (see p. 36, Bulletin No. 1), though there the maximum occurred two hours later than here. It is probable that the presence of the lake has something to do with the minimum at 7 p. m. (19 hours). Any wind from the north-northeast to east-southeast, and from south-southwest to west-northwest, would be slightly accelerated because of the less friction on the water, and the occurrence of winds from this direction at midnight or 6 a. m. would increase the velocity. The morning maximum may be due to the same cause as that producing the higher velocity on mountains, or else the upper current, which has a greater relative velocity, may gradually work down toward the earth's surface in the morning, as the air cools off and is contracted. The fact that this effect was almost *nil* in 1889, when the anemometer was farther from the lake and more than 100 feet lower, seems to indicate some such explanation as this. It is probable that the tower 400 feet high to be built in Chicago may assist in solving this problem.

In order to determine whether the direction of the wind had anything to do with these anomalous results, Table XXXIX was prepared, giving the wind velocity according to the hour of the day and its direction for each month, from April–October. The bold face figures show maxima in the velocity in the morning. It will be seen that these occur without respect to the direction. The afternoon minimum, however, seems to be slightly more marked with the land winds.

Table XXXIX.—*Velocity of wind, in miles, for each hour and direction, Chicago.*

APRIL, 1890.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
		......	23	......	7?	......	29	22	20	20	22	......	17	21	21	16	18	25	......	7?	......	7	8	8	22.8?
		22	23	22	25	25	25	22	22	22	19	20	20	21	23	24	22	21	24	22	24	24	24	24	22.5
		18	20	19	13	19	19	17	16	14	12	13	12	6	10	10	9	13	15	13	11	9	10	10	15.8
		15	13	15	20	16	16	14	14	15	14	12	10	12	15	14	9	9	15	11	12	15	17	21	13.9
....	18	18	16	17	14	17	17	12	16	15	20	24	22	21	24	6	27	27	23	21	22	13	13	9	20.2
thwest	30	24	25	27	27	28	38	32	28	26	29	32	33	32	30	31	30	25	34	29	26	26	28	29	27.8
West	21	20	......	......	......	......	18	16	9	11	14?	15	17	16	17	17	17	13	......	......	......	......	......	......	14.8
Northwest	......	17	14	16	14	......	14	......	......	......	19	14	15	14	......	......	......	......	......	10	......	......	......	......	18.5

MAY, 1890.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
North...........	17	13	16	13	17	15	18	15	......	11	8	......	......	15	......	9	......	......	15	17	14	19	18	15	15.7
Northeast	25	20	22	21	21	21	22	21	22	23	26	21	21	20	20	19	18	17	18	18	20	19	19	18	19.9
East	......	......	......	6	......	......	25	......	......	......	10	8	12	11	10	8	11	13	22	13	11	15	11	8	13.2
Southeast.......	19	13	11	13	15	17	13	11	11	7	9	14	15	13	13	15	9	11	14	10	10	7	14	12	12.0
South	15	15	15	18	20	15	18	17	16	23	25	......	26	......	14	25	26	......	15	12	17	11	17	16	18.7
Southwest	26	21	21	21	20	22	21	21	20	19	23	25	21	26	28	28	27	24	26	20	22	22	23	24	22.6
West	17	16	15	18	18	17	18	15	13	14	14	20	19	17	18	20	13	17	18	13	13	22	16	17	17.8
Northwest	7	11	13	13	12	12	15	14	12	14	17	15	16	13	......	18	21	20	23	19	12	11	......	21	14.7

JUNE, 1890.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
North...........	......	10	9	11	9	......	......	8	5	......	8	7	......	......	......	23	12	......	......	9	7	7	3	7	10.9
Northeast	8	6	9	7	6	6	10	8	8	6	7	11	12	14	12	13	13	12	12	11	10	11	8	9	11.3
East	11	8	9	11	11	13	9	6	13	4	2	5	6	7	10	6	8	11	12	7	6	8	9	9	10.5
Southeast.......	9	15	7	10	10	11	13	13	10	8	9	10	9	10	11	13	15	14	11	11	11	15	9	7	11.9
South	12	19	21	13	12	13	11	13	17	19	18	13	8	8	29?	32?	33?	3	18	7	10	14	18	14	15.4
Southwest	17	18	18	16	15	17	17	16	18	16	19	21	20	22	22	25	22	23	19	20	17	23	15	15	20.8
West	11	9	13	14	14	16	14	10	11	12	11	10	19	14	31?	......	......	17	16	11	7	7	......	23	14.4
Northwest	15	14	9	6	9	9	12	4	8	4	14	5	15	11	12	11	18	26	14	......	17	12	16	14	10.5

JULY, 1890.

		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	Mean
North...........	11	10	7	10	8	9	......	7	7	15	16	......	12	12	14	15	15	14	6	20	12	11	12	13	16.0
Northeast	15	18	18	17	19	19	17	17	16	14	14	15	15	17	18	19	17	15	19	16	18	19	17	16	17.1
East	20	......	......	......	13	......	21	13	11	12	12	7	7	9	7	11	9	10	12	10	7	3	......	......	11.7
Southeast.......	12	12	12	15	17	17	18	12	12	13	9	12	11	7	9	9	12	15	12	11	10	10	10	9	10.8

South	17	20	12	14	**16**	13	10	10	13	15	17	......	18	27	16	......	15	16	19	18	14	19	19	22	16.3
Southwest	23	22	22	20	18	**19**	**20**	18	13	14	17	20	20	21	25	21	22	24	21	18	16	16	17	23	20.8
West	13	17	......	......	**16**	**15**	**7**	12	18	12	12	14	15	15	16	16	19	......	21	14	12	12	10	8	15.1
Northwest	15	14	13	12	11	**13**	**13**	**13**	12	18	17	13	17	......	......	17	15	15	12	......	......	15	11	12	14.2
AUGUST, 1890.																									
North...........	18	17	......	21	14	**16**	......	......	15	13	17	17	13	11	9	16	17	......	19	......	......	18	17	15	15.1
Northeast	20	17	17	15	11	**15**	**17**	**14**	13	16	15	15	15	16	16	15	15	14	16	16	20	18	20	20	16.1
East	14	18	13	12	**17**	**14**	**15**	**13**	8	11	12	9	10	10	11	12	10	11	10	12	12	13	12	11	12.0
Southeast.......	12	11	8	14	8	8	**15**	8	10	10	9	10	9	8	8	11	11	10	14	11	12	9	10	11	10.1
South	13	11	18	15	15	13	**14**	10	12	11	11	12	11	......	14	16	22	20?	......	12	11	9	8	8	14.3
Southwest	14	13	12	13	13	**15**	**20**	**16**	14	15	19	18	18	19	23	24	21	21	14	14	15	13	13	14	18.9
West	16	12	9	10	**15**	**13**	**12**	10	12	15	13	17	20	17	14	......	32?	15	20	14	14	17	17	21?	15.2
Northwest......	20	16	13	10	12	**14**	**14**	**14**	11	13	12	13	13	......	......	......	34?	......	......	......	......	11	9	20?	13.1
SEPTEMBER, 1890.																									
North...........	15	14	12	12	14	14	**15**	13	16	13	10	4	19	15	14	17	14	14	17	11	16	16	13	12	15.0
Northeast	20	17	19	18	21	**21**	**24**	**23**	19	20	20	18	17	17	20	18	18	18	19	18	19	20	18	18	18.9
East	15	14	16	18	13	14	15	15	**17**	**17**	**18**	15	7	10	12	11	10	10	12	25?	26	23	16	20	16.2
Southeast.......	19	18	17	17	17	13	11	......	14	......	22	24	8	14	12	13	15	13	12	12	17	17	16	17	14.1
South	21	17	17	16	17	**18**	**21**	12	16	10	9	7	16	20	23	20	......	14	16	14	15	17	19	18	16.8
Southwest	24	23	18	18	18	17	17	17	16	**18**	**19**	17	17	16	19	20	20	18	16	16	15	18	17	18	18.3
West	......	12	12	16	18	19	**23**	**22**	**25**	**24**	22	24	21	18	10	......	19	17	18	14	......	......	......	......	19.5
Northwest......	13	......	......	......	......	......	......	......	......	9	......	......	......	31?	24	31?	25	17	18?	11	15	13	24	22	19.5
NOVEMBER, 1890.																									
North...........	22	19	29	17	**18**	**18**	**21**	17	17	19	20	17	18	10	16	14	15	14	13	4?	14	11	14	12	16.8
Northeast	22	18	18	22	12	......	**23**	17	......	18?	18	31	28	16	17	17	19	17	17	21	21	21	21	20	19.4
East	16	......	......	......	19?	**20**	**20**	15?	**21**	12?	10	19	14	19	16	21	22	22	11	12	15	9	11	10	15.1
Southeast.......	......	19?	14	8	5?	......	8	3?	10	3?	......	3?	......	......	7	10	8	7	......	13	10	12	12	17	15.9
South	16	15	16	16	16	17	**34**	9	**22**	**3?**	5?	......	11	10	......	12	7	7	15	15	13	12	16	16	15.6
Southwest	17	17	18	18	21	20	16	**24**	**24**	**23**	20	19	22	21	20	21	19	17	16	16	17	21	17	19	19.8
West	21	18	19	19	17	17	**18**	15	15	20	17	17	17	18	18	18	18	17	17	16	16	18	18	18	17.7
Northwest......	14	12	14	13	14	14	**15**	13	13	11	15	15	14	16	25	18	18	17	17	17	17	16	17	16	14.6

NOTE.—Bold face figures show that the increase in velocity in the air is the same for all directions.

To show the effect of the different months upon the hourly wind direction, Fig. 20 has been prepared. This gives, in graphic form, the departure of the daily mean from each hourly record. In this figure the principal maximum between 2 and 3 p. m. stands out very prominently as well as the minima at 8 a. m. and p. m. The curve of sunrise and sunset is here given dotted. The principal minimum occurs very soon after sunset, especially in the warmer months, while the morning maximum comes about sunrise; but the serious difficulty is in trying to explain the prominent minimum at 8 a. m. It is a matter of observation that during many winds there is a dying down at sunset to be followed by a decided freshening at sunrise.

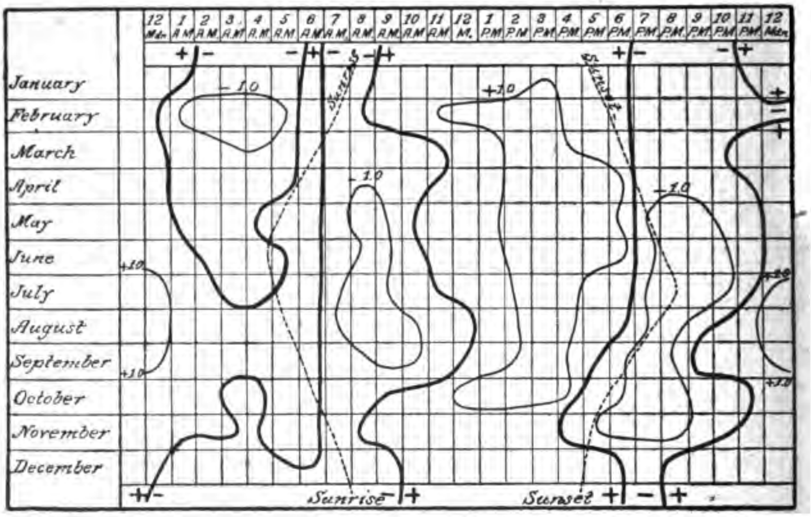


FIG. 20.—*Departure of hourly wind velocity from the daily mean, Chicago.*

VELOCITY OF WIND AT DIFFERENT HOURS.

The question has been asked as to the velocity of the higher winds during the day hours, especially in determining the possibility of running windmills. Table XL has been prepared with this in view, and shows the number of times the wind blew at different velocities during the hours of the day, and in two or more locations of the anemometer. These figures show a great increase in the occurrence of the higher winds as the height of the anemometer is increased.

The last column of this table gives the percentage of winds of each velocity during the month. For example, 25 per cent. of the winds in January were from 0 to 7, 57 per cent. were from 8 to 14, etc.

TABLE XL.—*Wind movement at different hours of the day*, 1884 *to* 1889.

(Number of times observed blowing from 0 to 7 miles per hour.)

Month.	11 to midnight.	3 to 4 a.m.	7 to 8 a.m.	11 to noon.	3 to 4 p.m.	7 to 8 p.m.	Total.	Per cent.
January	31	42	35	27	24	28	187	25
April	83	79	75	43	40	73	393	36
July	124	134	124	77	50	104	613	55
October	89	87	84	48	46	88	442	39
Mean	81.8	85.5	79.5	48.8	40.0	73.2	....	39
From 8 to 14 miles.								
January	69	66	68	76	65	79	423	57
April	70	74	72	81	89	80	466	43
July	53	50	56	89	111	71	430	38
October.	73	86	81	100	98	76	514	46
Mean	66.2	69.0	69.2	86.5	91.0	76.5	....	46
From 15 to 20 miles.								
January	22	11	16	15	27	13	104	14
April	24	19	24	41	37	20	165	15
July	9	2	5	19	22	11	68	6
October	20	12	16	33	31	18	130	12
Mean	18.8	11.0	15.2	27.0	29.2	15.5	....	12
Above 20 miles.								
January	2	5	5	6	8	4	30	4
April	3	8	9	15	14	7	56	5
July	0	0	1	1	3	0	5	1
October	4	1	5	6	10	4	30	3
Mean	2.2	3.5	5.0	7.0	8.8	3.8	....	3

Wind movement at different hours of the day, 1890 *and* 1891 (*Auditorium*).

Number of times observed blowing from 0 to 7 miles per hour.

Month.	11 to midnight.	3 to 4 a. m.	7 to 8 a. m.	11 to noon.	3 to 4 p. m.	7 to 8 p. m.	Total.	Per cent.
January.	12*	14	16	12	11	16	81	22
April	5	6	7	3	3	7	31	9
July	14	16	13	11	12	15	81	22
October........	7	5	9	7	8	13	49	13
Total	36	51	45	33	34	51	....	17
From 8 to 14 miles.								
January.	30*	26	24	22	27	24	153	41
April	16	15	16	17	11	17	92	26
July	28	20	24	25	21	22	140	38
October........	27	27	17	23	20	22	136	37
Total	101	88	81	87	79	85	....	35
From 15 to 20 miles.								
January.	12*	15	15	19	15	17	93	25
April	17	12	14	18	19	15	95	26
July	6	13	14	11	16	16	76	20
October........	13	17	20	13	13	16	92	25
Total	48	57	63	65	63	64	....	24

*January, 1890, at old office.

TABLE XL.—*Wind movement, etc.*—Continued.

(Above 20 miles.)

[illegible]	11 to midnight.	3 to 4 a. m.	7 to 8 a. m.	11 to noon.	3 to 4 p. m.	7 to 8 p. m.	Total.	Per cent.
[illegible]	8*	7	7	9	9	5	45	12
[illegible]	22	27	23	22	27	21	142	39
[illegible]	14	13	11	15	13	9	75	20
[illegible]	15	13	16	19	21	11	95	25
[illegible]	59	60	57	65	70	46	....	24

* January, 1890, at old office.

MAXIMUM VELOCITIES OF WIND.

Table XLI gives the occurrence of winds above 35 miles per hour from 1887 to January, 1890, and of 40 miles per hour since the latter date. It will be seen that since 1887 the anemometer exposure has made a great increase in these velocities.

TABLE XLI.—*Dates on which the maximum velocity of the wind was* 35 *miles per hour* (40 *miles since February*, 1890).

[illegible]	Date.	Year.	Date.	Year.	Date.	Year.	Date.
[illegible]	Apr. 1	1888..........	Mar. 22	1890..........	Feb. 28	1890..........	June 3
[illegible]	June 25	1888..........	Apr. 13	1890..........	Mar. 14	1890..........	June 4
[illegible]	Mar. 5	1888..........	May 3	1890..........	Mar. 25	1890..........	June 5
[illegible]	Apr. 10	1888..........	May 4	1890..........	Mar. 26	1890..........	June 6
[illegible]	July 3	1888..........	May 28	1890..........	Mar. 27	1890..........	June 14
[illegible]	None.	1888..........	July 11	1890..........	Mar. 28	1890..........	June 22
[illegible]	Apr. 15	1888..........	July 12	1890..........	Apr. 3	1890..........	June 27
[illegible]	Apr. 19	1888..........	July 31	1890..........	Apr. 4	1890..........	June 29
[illegible]	June 6	1888..........	Aug. 2	1890..........	Apr. 8	1890..........	July 4
[illegible]	June 7	1888..........	Aug. 21	1890..........	Apr. 9	1890..........	July 14
[illegible]	Mar. 19	1888..........	Aug. 31	1890..........	Apr. 11	1890..........	July 30
[illegible]	None.	1888..........	Nov. 6	1890..........	Apr. 12	1890..........	Aug. 3
[illegible]	None.	1888..........	Nov. 8	1890..........	Apr. 13	1890..........	Aug. 8
[illegible]	Apr. 27	1888..........	Nov. 9	1890..........	Apr. 14	1890..........	Sept. 19
[illegible]	Oct. 8	1888..........	Dec. 4	1890..........	Apr. 15	1890..........	Sept. 24
[illegible]	None.	1888..........	Dec. 26	1890..........	Apr. 24	1890..........	Sept. 27
[illegible]	Oct. 14	1888..........	Dec. 27	1890..........	Apr. 26	1800..........	Oct. 13
[illegible]	Feb. 26	1889..........	Jan. 9	1890..........	Apr. 29	1890..........	Oct. 14
[illegible]	Mar. 2	1889..........	Jan. 17	1890..........	Apr. 30	1890..........	Oct. 15
[illegible]	Apr. 4	1889..........	Mar. 18	1890..........	May 1	1890..........	Oct. 18
[illegible]	Apr. 23	1889..........	Apr. 24	1890..........	May 3	1890..........	Oct. 19
[illegible]	May 2	1889..........	May 30	1890..........	May 8	1890..........	Nov. 1
[illegible]	Sept. 27	1880..........	May 31	1890..........	May 9	1890..........	Nov. 5
[illegible]	Oct. 3	1889..........	July 28	1890..........	May 10	1890..........	Nov. 8
[illegible]	Oct. 6	1889..........	Nov. 27	1890..........	May 15	1890..........	Nov. 9
[illegible]	Nov. 18	1889..........	Nov. 28	1890..........	May 16	1890..........	Nov. 13
[illegible]	Nov. 19	1889..........	Dec. 29	1890..........	May 17	1890..........	Dec. 13
[illegible]	Feb. 13	1890..........	Jan. 8	1890..........	May 18	1890..........	Dec. 23
[illegible]	Feb. 14	1090......... .	Feb. 4	1890..........	May 21	1890..........	Deb. 27
[illegible]	Feb. 20	1890..........	Feb. 5	1890..........	May 22	1890..........	Dec. 28
[illegible]	Feb. 26	1890..........	Feb. 8	1890..........	May 24		
[illegible]	Mar. 21	1890..........	Feb. 19	1890..........	May 28		

WIND DIRECTION.

s been given already a discussion of wind direction as
he lake. In Table XLII are given the mean wind direc-
month for 20 years. The general tendency of the wind
ly quarter is shown quite plainly in the colder months,
er months the mean direction is quite irregular owing

to the fewness of the observations in part, and to the difference in the exposure in wind vanes in greater part.

TABLE XLII.—*Wind direction at Chicago, by years.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
	°	°	°	°	°	°	°	°	°	°	°	°
1872	s 67 w	n 52 w	n 67 w	s 8 w	s 24 w	s 11 w	n 78 w	s 77 w	s 22 w	s 83 w	s 39 w	s 66 w
1873	s 37 w	s 51 w	s 65 w	n 2 w	n 47 e	s 69 e	n 85 w	n 49 e	s 71 w	s 62 w	s 75 w	s 54 w
1874	s 53 w	s 54 w	n 76 w	n 1 w	n 74 e	s 8 w	s 22 e	n 20 e	s 17 w	n 81 w	s 64 w	s 83 w
1875	s 82 e	s 58 e	s 89 w	n 15 e	s 26 w	n 46 w	n 56 w	s 16 e	s 49 e	s 72 e	s 21 e	s 51 e
1876	s 50 w	s 44 w	n 60 w	s 6 e	n	s 35 w	n 10 e	s 50 e	n 2 e	s 42 w	s 55 w	s 65 w
1877	s 43 w	n 62 w	n 38 w	n 22 e	s 64 e	s 56 w	s 33 w	s 76 e	s 24 e	n 59 e	s 75 e	s 18 e
1878	s 50 w	n 74 e	s 60 e	n 54 e	s 28 e	s 45 e	n 86 e	s 34 e	s 48 w	s 59 w	n 79 w	s 82 w
1879	s 80 w	s 79 w	s 64 w	n 40 e	n 80 e	n 88 e	s 2 w	s 9 e	s 58 w	s 33 w	s 61 w	s 46 w
1880	s 63 w	s 62 w	s 34 w	s 34 w	s 7 w	s 28 w	s 31 w	s 56 e	s 32 w	s 44 w	s 63 w	n 77 w
1881	n 68 w	s 1 w	n 36 w	n 43 w	n 30 e	n 7 w	n 23 w	s 80 e	s 27 w	s 25 e	s 59 w	s 73 w
1882	s 65 w	s 63 w	s 83 w	n 39 e	n 64 e	n 31 w	s 73 w	n 48 e	s 52 e	s 17 e	s 33 w	s 54 w
1883	s 59 w	s 64 w	n 46 w	n 89 e	n 40 e	s 85 w	n 42 w	n 5 w	n 41 e	n 48 e	s 57 w	s 73 w
1884	s 73 w	n 77 w	n 74 w	n 27 e	s 9 e	n 28 e	n 12 w	s 61 e	s 13 w	s 49 w	s 79 w	s 55 w
1885	s 58 w	s 62 w	n 77 w	n 66 e	n 15 e	s 32 e	s 82 e	n 34 e	s 6 e	n 75 w	s 81 w	s 46 w
1886	s 56 w	s 40 w	n 66 w	n 14 w	n 51 e	n 75 e	n 56 e	s 76 e	s 5 e	s 5 w	s 55 w	s 41 w
1887	s 79 w	s 57 w	n 23 w	s 16 w	n 65 e	n 81 e	s 60 e	n 57 e	s 75 e	s 70 w	s 72 w	s 51 w
1888	n 83 w	s 59 w	n 13 w	n 9 w	s 82 e	s 40 e	n 79 e	n 84 w	s 6 w	s 82 w	n 79 w	s 77 w
1889	s 69 w	s 88 w	n 3 e	n 78 e	n 84 w	n 68 w	s 79 e	s 29 w	s 34 w	n 12 e	n 80 w	s 42 w
1890	s 69 w	s 87 w	n 28 w	s 77 e	s 45 w	s 25 e	s 61 e	s 76 e	s 74 e	n 46 w	s 85 w	n 87 w
1891	s 78 w	s 69 w	n 67 e	n 85 e	n 65 e	s 61 e	s 4 w	s 45 w	s 22 w	s 63 w	s 85 w	s 71 w
Mean for 15 years	s 61 w	s 51 w	n 69 w	n 27 e	s 85 e	s 19 w	s 43 w	s 71 e	s 21 w	s 36 w	s 59 w	s 59 w

NOTE.—Mean yearly direction, s. 53° w.

DEW-POINT AND RELATIVE HUMIDITY.

During the years 1882–1886 observations were made 5 times each day, at 6.10 and 10.10 a. m., and 2.10, 6.10, and 10.10 p. m. (Chicago time). Table XLIII gives these observations for dew-point and relative humidity, which never before have been worked up. Fig. 21 shows the departure from the mean by hours and months. In the colder months the dew-point reaches a minimum at 6 a. m. and a maximum at 3 p. m., while in the warmer months there is but little variation.

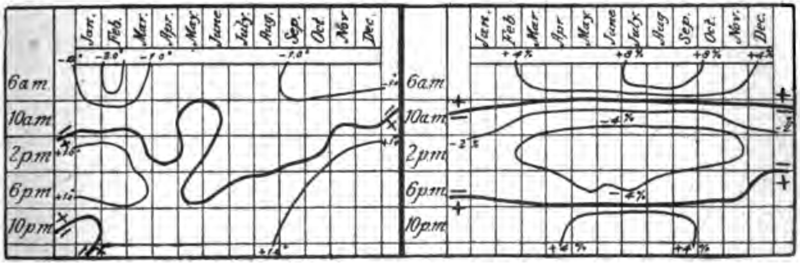


FIG. 21.—*Dew-point and relative humidity departures.*

TABLE XLIII.—*Mean monthly dew-point and relative humidity, Chicago.*

DEW-POINT.

Years.	January.					February.					March.					April.				
	6.	10.	2.	6.	10.	6.	10.	2.	6.	10.	6.	10.	2.	6.	10.	6.	10.	2.	6.	10.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1882	21.2	21.7	26.5	24.5	23.6	29.2	30.8	33.3	33.1	31.4	30.8	31.2	33.2	34.0	33.3	36.6	35.5	36.1	37.3	37.7
1883	8.7	9.2	10.0	10.1	8.3	11.2	14.2	15.2	15.6	14.7	18.1	17.7	18.3	19.8	19.3	32.9	33.4	33.2	34.2	33.6
1884	9.0	10.6	13.9	10.9	8.6	16.9	19.2	21.3	20.1	18.5	22.7	24.3	26.0	26.0	24.5	33.4	33.2	32.6	32.7	33.8
1885	9.2	9.4	12.4	13.2	11.7	7.1	10.0	15.5	13.4	12.0	20.8	22.3	24.6	24.3	23.6	37.2	38.2	38.2	38.0	38.6
1886	15.0	17.7	17.8	19.5	18.5	19.4	21.9	21.5	23.9	23.2	28.3	29.2	29.5	31.7	31.2	42.8	44.8	44.9	44.6	43.8
Mean dew-point	12.6	13.7	16.2	15.7	14.1	16.8	19.2	21.4	21.2	20.0	24.1	24.9	26.3	27.2	26.4	36.6	37.0	37.0	37.4	37.5
Grains per cubic foot	0.940	0.986	1.100	1.076	1.003	1.128	1.254	1.379	1.367	1.298	1.547	1.599	1.695	1.759	1.702	2.525	2.563	2.563	2.601	2.611

	May.					June.					July.					August.				
1882	41.8	42.3	41.9	42.2	42.2	55.5	56.5	55.0	56.1	56.5	56.8	56.1	56.0	56.8	58.1	63.1	62.9	62.5	64.1	64.0
1883	42.1	43.1	41.2	40.8	41.9	54.3	55.2	55.4	55.6	55.4	58.9	59.4	60.2	60.8	60.9	55.8	56.0	56.9	57.1	57.7
1884	43.9	43.5	44.8	43.8	44.5	55.0	55.7	56.0	54.7	56.5	58.2	57.9	58.1	58.9	59.0	57.5	56.9	56.5	58.1	58.1
1885	42.0	42.6	42.5	42.4	44.2	55.0	55.6	54.7	54.4	55.7	62.8	63.8	63.6	64.3	64.5	58.2	58.7	57.2	58.3	59.9
1886	46.3	47.2	47.6	46.3	48.4	56.0	56.5	56.5	56.5	56.9	59.6	60.6	60.3	60.7	61.6	62.0	62.1	62.4	62.5	63.2
Mean dew-point	43.4	43.7	43.6	43.1	44.2	55.2	55.9	55.5	55.5	56.2	59.3	59.6	59.6	60.3	60.8	59.3	59.3	59.1	60.0	60.6
Grains per cubic foot	3.236	3.271	3.259	3.201	3.330	4.894	5.011	4.944	4.944	5.063	5.623	5.680	5.580	5.785	5.933	5.623	5.623	5.585	5.756	5.874

	September.					October.					November.					December.				
1881	56.7	58.8	58.7	60.4	58.9	48.3	49.2	49.2	50.0	49.8	32.2	33.3	34.2	33.8	32.4	30.8	31.0	32.9	32.8	31.6
1882	54.0	53.8	54.6	55.4	55.9	46.7	49.2	49.0	51.5	50.1	33.9	34.1	35.1	35.1	34.3	17.5	17.5	20.2	20.6	19.1
1883	49.2	49.6	49.1	50.0	50.7	42.0	42.1	42.2	42.6	42.5	28.8	30.0	32.0	31.1	30.7	19.4	21.8	24.0	23.3	21.1
1884	56.4	57.2	56.6	58.2	58.8	44.6	46.0	46.7	48.3	46.5	30.4	32.7	33.7	34.2	32.2	21.0	22.6	24.1	24.6	23.2
1885	52.6	52.8	54.1	54.3	55.4	41.3	41.8	42.5	43.6	42.9	33.3	35.1	35.3	36.2	34.5	24.5	25.7	27.6	27.5	25.7
Mean dew-point	53.8	54.4	54.6	55.7	55.9	44.6	45.7	45.9	47.2	46.4	31.7	33.0	34.1	34.1	32.8	22.6	23.7	25.8	25.8	24.1
Grains per cubic foot	4.664	4.762	4.794	4.978	5.011	3.378	3.513	3.520	3.653	3.602	2.102	2.208	2.301	2.301	2.192	1.452	1.521	1.660	1.660	1.547

RELATIVE HUMIDITY.

	January.					February.					March.					April.				
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
1882	83.2	79.3	83.5	80.5	82.8	82.3	75.8	70.9	75.6	77.9	84.6	77.5	74.5	77.6	81.2	77.7	65.5	64.7	69.4	74.4
1883	74.5	71.3	67.4	73.6	73.7	73.2	67.0	61.6	66.5	70.1	66.2	54.6	51.6	56.6	60.6	70.9	60.7	57.6	61.1	63.8
1884	71.5	68.0	67.3	66.9	66.9	71.7	71.0	68.8	67.9	67.9	72.5	65.8	62.7	68.2	67.9	74.6	63.0	58.9	62.0	69.2
1885	78.3	71.2	67.3	72.8	76.6	78.8	73.2	80.1	77.4	80.0	78.6	72.4	71.9	73.1	75.1	80.8	71.2	70.1	74.8	78.4
1886	83.9	86.0	79.2	85.5	88.0	80.6	80.1	68.6	78.4	80.9	83.7	75.7	69.1	78.9	81.2	86.9	79.6	75.9	80.7	85.5
Mean.	78.3	75.2	72.9	75.9	77.6	77.3	73.4	70.0	73.2	75.4	77.1	69.2	66.0	70.9	73.4	78.2	68.0	65.4	69.6	74.3

	May.					June.					July.					August.				
1882	76.1	67.9	63.6	66.7	74.4	82.2	72.6	68.9	70.4	80.8	74.1	61.7	59.0	60.3	72.2	84.9	72.3	66.4	76.0	80.6
1883	74.7	65.3	61.2	62.9	72.0	77.5	69.6	67.2	69.9	77.1	76.0	64.5	59.1	61.6	73.6	73.8	62.6	59.4	62.4	71.3
1884	71.9	59.8	57.1	58.1	67.6	75.9	68.6	65.5	70.5	77.7	76.2	64.2	61.0	63.5	72.6	78.2	62.2	56.6	63.6	70.0
1885	75.7	65.5	62.8	65.3	74.1	77.5	66.3	59.6	62.9	75.4	80.3	70.0	64.8	68.3	77.4	79.6	70.3	62.8	67.3	75.6
1886	77.1	68.5	64.7	63.5	73.7	76.9	69.2	65.5	66.9	75.6	74.9	67.1	61.5	63.6	73.8	79.4	68.1	64.2	67.8	74.9
Mean.	75.1	65.4	61.9	63.3	72.4	78.0	69.3	65.3	68.1	77.3	76.3	65.5	61.1	63.5	73.9	79.2	67.1	61.9	67.4	74.5

	September.					October.					November.					December.				
1881	75.6	66.0	60.0	69.5	73.0	83.8	75.4	70.6	78.2	82.7	81.2	77.1	71.7	78.1	78.0	86.0	79.0	76.7	80.4	82.5
1882	79.1	64.4	60.7	66.4	73.5	81.2	72.7	66.9	77.5	81.2	80.2	73.8	71.0	74.4	76.3	77.3	70.2	70.5	75.0	76.1
1883	76.4	62.7	59.5	66.6	71.3	77.8	69.7	65.6	68.7	71.9	71.9	64.9	60.9	62.6	65.9	73.8	70.0	67.4	70.6	69.5
1884	77.4	64.5	57.4	63.7	71.1	77.1	65.6	60.0	69.3	70.9	81.6	75.3	68.1	75.2	76.3	82.8	79.9	75.6	81.2	80.4
1885	76.8	66.1	63.5	68.6	75.1	80.8	68.9	64.4	70.6	75.3	79.8	76.3	71.9	75.6	76.5	82.5	80.3	79.1	82.7	82.0
Mean.	77.1	64.7	60.2	67.0	72.8	80.1	70.5	65.5	72.9	76.4	78.9	73.5	68.7	73.2	74.6	80.5	75.9	73.9	78.0	78.1

The relative humidity shows a maximum at 6 a. m. in all the months and a minimum at 2 p. m.

The average monthly relative humidity from 1886 to 1891 is given in Table XLIV. There is a maximum in January and a minimum in July with a secondary maximum well marked in June, due possibly to the prevalence of lake winds at the time of observation.

TABLE XLIV.—*Mean relative humidity of Chicago.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Annual.
	%	%	%	%	%	%	%	%	%	%	%	%	%
1886	84	77	78	83	72	73	70	73	71	71	77	76	75
1887	79	83	75	62	68	70	67	68	72	70	71	78	72
1888	75	76	72	62	70	66	68	66	66	69	78	81	71
1889	83	83	76	75	71	79	73	66	69	70	83	76	75
1890	81	82	74	72	71	73	64	74	76	82	73	76	75
1891	82	81	84	75	67	81	70	74	66	67	79	77	75
Mean	80.7	80.3	76.5	71.5	69.8	73.7	68.7	70.2	70.0	71.5	76.8	77.3	73.9

CLOUDS.

Table XLV gives the average cloudiness on a scale 0–10 for 18 years. Observations were made three times each day, except only twice daily from July–December, 1888. The maximum cloudiness is in December, and the minimum in July and August. The latter interesting fact may be explained, in part at least, by the occurrence of cool lake winds which have their moisture dissipated by the warm air over the land surface. No such minimum as this is to be found at any other station in the interior near Chicago.

TABLE XLV.—*Average cloudiness, 0 to 10.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1871	6.5	4.8	5.2	5.8	5.0	4.7	3.8	3.2	3.5	......	6.5	5.0	......
1872	6.0	5.0	5.2	4.7	4.7	4.5	3.7	4.0	4.0	3.0	5.5	5.7	4.7
1873	7.5	5.2	5.5	7.2	6.2	4.5	4.2	4.0	5.0	5.5	6.2	6.0	5.6
1874	6.0	6.2	5.2	5.2	4.5	5.0	3.0	3.7	4.2	5.0	5.0	6.2	4.9
1875	4.8	5.0	5.7	5.0	3.5	5.8	4.8	3.7	4.8	6.0	6.3	6.0	5.1
1876	5.8	4.5	6.5	4.8	4.2	6.2	3.8	3.2	5.2	4.8	8.0	5.5	5.2
1877	5.0	4.2	5.7	5.0	3.5	4.5	3.0	4.0	3.5	6.5	7.2	6.2	4.9
1878	6.2	6.5	6.2	6.0	4.7	5.0	5.0	3.7	4.5	5.5	5.2	6.0	5.4
1879	5.0	6.0	5.7	3.5	4.5	4.5	3.5	4.2	4.2	4.7	5.7	6.5	4.8
1880	5.7	5.5	5.5	5.2	4.0	4.7	4.5	2.2	4.5	4.7	5.5	6.5	4.9
1881	5.7	6.2	6.5	5.0	3.0	5.5	3.6	3.4	4.3	5.8	5.7	5.5	5.0
1882	5.3	4.9	6.3	6.1	6.1	5.9	4.3	4.9	3.8	4.6	6.6	5.6	5.4
1883	5.6	5.0	5.0	4.9	6.7	5.4	4.4	3.5	3.9	6.9	4.4	5.1	5.1
1884	5.4	7.1	6.5	5.9	4.6	5.0	4.7	3.5	3.7	4.2	4.8	7.4	5.2
1885	4.8	5.1	5.7	6.1	4.9	4.5	3.8	4.6	4.5	5.5	6.7	5.4	5.1
....	6.4	5.6	5.7	5.0	4.2	4.0	2.6	4.5	4.6	3.8	5.2	5.7	4.8
...	6.4	6.8	5.2	4.6	3.8	4.2	3.0	4.1	5.9	4.9	5.2	7.5	5.1
...	6.1	4.9	6.6	4.1	6.0	4.7	4.6	4.3	3.0	4.2	5.0	5.6	4.9
.	5.7	5.5	5.8	5.2	4.7	4.9	3.9	3.9	4.3	5.0	5.8	6.0	5.1

Table XLVI gives the mean cloudiness at the hours 6 and 10 a. m., and 2, 6, and 10 p. m., during the years 1882–1886. Here we find a marked minimum in the graphic presentation of this table at 10 p. m. (Fig. 22), while there is a maximum in all the months at 2 p. m., or during the hottest part of the day. At first sight this appears to be a contradiction to the July and August minimum occurring at the hottest part of the year, but this disappears if we consider that that is produced by the lake winds, while here the maximum may be due to a slight upward tendency which would carry the warm air into a cooler region where its moisture would be condensed.

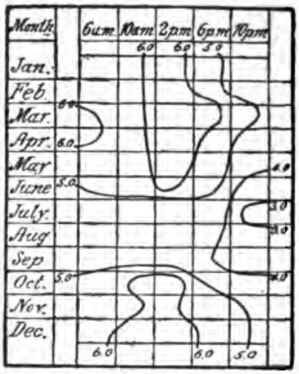


FIG. 22.—*Diurnal and monthly variation of cloudiness.*

TABLE XLVI.—*Mean cloudiness, Chicago.*

Year.	January.					February.					March.					April.				
	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.
1882..........	4.1	5.6	6.7	6.5	5.2	5.1	5.1	5.7	3.7	3.8	6.6	6.9	6.4	6.9	5.8	6.4	5.3	6.7	4.7	5.2
1883..........	5.9	5.8	6.3	5.2	4.5	4.1	5.2	5.6	4.2	5.3	5.2	5.5	5.7	5.8	4.1	6.0	4.7	5.2	4.2	3.5
1884..........	6.2	5.8	6.1	4.3	3.9	6.6	6.2	8.1	7.2	6.5	6.6	5.8	6.9	6.0	6.1	5.9	5.4	6.9	6.4	4.8
1885..........	4.2	5.0	5.7	3.9	4.6	4.5	5.6	5.7	4.8	5.1	5.3	4.4	6.3	6.7	5.4	6.2	6.4	6.7	6.5	5.5
1886..........	6.1	7.0	7.1	5.5	6.1	6.6	6.8	6.2	5.2	3.9	6.1	6.2	5.8	7.1	5.2	5.7	5.8	5.5	6.6	3.7
Mean ..	5.3	5.8	6.4	5.1	4.9	5.4	5.8	6.3	5.0	4.9	6.0	5.8	6.2	6.5	5.3	6.0	5.5	6.2	5.7	4.5

Year.	May.					June.					July.					August.				
	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.
1882..........	5.8	5.6	6.7	5.4	5.7	6.4	5.8	6.7	5.4	4.7	3.9	4.1	4.8	4.7	4.1	5.6	5.4	5.4	5.8	3.6
1883..........	7.5	6.4	7.3	6.6	5.4	5.4	6.0	7.2	6.7	3.7	5.2	4.6	4.8	4.7	3.2	2.9	3.7	4.5	3.9	3.0
1884..........	4.8	5.3	5.6	5.9	3.3	6.1	5.2	5.5	5.4	3.3	5.3	5.1	6.2	5.9	2.5	4.2	4.5	4.3	3.7	2.1
1885..........	5.2	4.7	5.1	5.6	4.4	4.8	5.0	5.3	4.1	3.3	4.3	4.2	4.6	4.9	2.5	5.7	5.4	4.7	4.6	3.4
1886..........	4.3	4.6	5.6	5.2	2.8	3.9	4.5	5.1	4.6	3.1	3.4	3.2	3.2	2.8	1.3	5.2	4.6	4.7	4.5	3.5
Mean ..	5.5	5.3	6.1	5.7	4.3	5.3	5.3	6.0	5.2	3.6	4.4	4.2	4.7	4.6	2.7	4.7	4.7	4.7	4.5	3.1

Year.	September.					October.					November.					December.				
	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.	6.	10.	14.	18.	22.
1881..........	5.0	4.7	5.0	4.0	2.9	5.9	7.5	6.1	5.6	5.2	5.6	6.0	5.9	6.1	5.6	5.1	6.1	6.7	5.3	4.7
1882..........	5.0	4.3	4.1	3.6	2.3	4.5	5.0	5.2	3.9	4.0	6.6	7.3	7.3	6.3	6.0	5.7	5.6	6.0	6.2	5.0
1883..........	3.9	3.9	4.8	4.3	2.9	7.0	7.3	7.4	7.3	6.4	4.6	4.0	5.0	5.0	3.5	4.8	6.5	6.7	4.4	3.7
1884..........	3.9	3.6	3.6	2.7	3.6	4.4	4.2	5.1	2.6	3.1	5.7	4.9	4.9	4.8	3.9	8.1	7.5	7.2	6.7	6.9
1885..........	4.7	4.4	4.8	5.2	4.0	5.4	6.0	7.1	5.0	4.0	6.8	6.2	7.1	6.8	6.1	4.7	6.3	6.7	5.8	4.9
Mean ..	4.5	4.2	4.5	4.0	3.1	5.4	6.0	6.2	4.9	4.5	5.9	5.7	6.0	5.8	5.0	5.7	6.4	6.7	5.7	5.0

CLEAR, FAIR, CLOUDY, AND RAINY DAYS.

A rainy day is one on which at least .01 inch of rain or more falls Table XLVII shows the prevalence of such days from 1871–18

From the summary at the close of this table we see that the maximum of clear days is in July with a minimum in January; of fair days these conditions occur in August and November, respectively; of cloudy days, in November and July; and of rainy days, in December and September.

TABLE XLVII.—*Number of clear, fair, cloudy, and rainy days at Chicago from* 1871 *to* 1891.

Year.	January.				February.				March.			
	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.
[illegible]	7	7	17	12	15	4	9	6	11	13	7	11
[illegible]	4	17	10	7	9	10	10	6	8	13	10	9
[illegible]	3	9	19	13	9	11	8	4	7	15	9	13
[illegible]	7	11	13	14	5	12	11	13	9	12	10	9
[illegible]	7	16	8	13	9	10	9	9	11	6	14	15
[illegible]	10	7	14	11	13	9	7	9	5	9	17	16
[illegible]	11	10	10	8	9	16	3	2	9	13	9	17
[illegible]	5	12	14	15	5	10	13	15	5	16	10	16
[illegible]	8	14	9	9	4	14	10	15	5	15	11	16
[illegible]	7	16	8	14	7	12	19	12	9	15	7	10
[illegible]	7	9	15	10	6	9	13	16	5	10	16	12
[illegible]	8	17	6	12	10	8	10	11	5	13	13	14
[illegible]	8	13	10	16	7	15	6	12	11	12	8	8
[illegible]	9	13	9	13	4	11	14	16	4	11	16	15
[illegible]	10	13	8	11	10	9	9	11	6	17	8	8
[illegible]	4	15	12	19	6	15	7	9	7	11	13	9
[illegible]	3	16	12	13	5	6	17	17	9	13	9	6
[illegible]	6	15	10	12	11	12	6	9	7	11	13	12
[illegible]	10	8	13	5	4	13	11	13	9	15	7	5
[illegible]	7	13	11	14	7	6	15	12	9	13	9	15
[illegible]	3	9	19	11	10	8	10	12	2	12	17	15
[illegible]	144	260	247	252	165	220	208	229	153	265	233	251
[illegible]	6.9	12.4	11.8	12.0	7.9	10.5	9.9	10.9	7.3	12.6	11.1	12.0

Year.	April.				May.				June.			
	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.
[illegible]	5	15	10	12	16	3	12	11	15	9	6	14
[illegible]	......	......	......	......	9	14	8	9	9	16	5	9
[illegible]	5	8	17	17	6	14	11	16	6	17	7	6
[illegible]	9	12	9	8	12	9	10	9	9	14	7	10
[illegible]	8	13	9	4	14	10	7	14	6	13	11	15
[illegible]	11	10	9	8	10	15	6	14	4	11	15	17
[illegible]	12	8	10	11	17	9	5	5	6	19	5	15
[illegible]	7	11	12	13	9	12	10	14	8	15	7	12
[illegible]	14	10	6	10	15	8	8	8	10	11	9	12
[illegible]	7	14	9	17	16	8	7	11	8	14	8	13
[illegible]	7	14	9	12	16	11	4	10	7	15	8	14
[illegible]	5	15	10	12	6	12	13	14	5	16	9	14
[illegible]	9	15	6	11	4	14	13	17	7	14	9	13
[illegible]	9	9	12	9	9	17	5	10	9	13	8	6
[illegible]	5	19	8	16	11	13	7	11	9	15	6	11
[illegible]	8	13	9	10	12	14	5	10	10	18	2	8
[illegible]	5	12	3	5	15	8	8	9	12	13	5	7
[illegible]	12	13	5	10	7	10	14	16	8	17	5	8
[illegible]	10	9	11	8	4	15	12	14	1	13	16	12
[illegible]	13	9	8	12	8	10	13	16	8	17	5	14
[illegible]	10	10	10	15	14	10	7	7	7	12	11	11
[illegible]	169	249	182	220	230	236	185	245	164	302	164	241
[illegible]	8.4	12.4	9.1	11.0	11.0	11.2	8.8	11.7	7.8	14.4	7.8	11.5

TABLE XLVII.—*Number of clear, fair, cloudy, and rainy days, etc.*—Continued.

Year	July.				August.				September.			
	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.
1871	14	10	7	8	16	10	5	8	16	9	5	4
1872	17	10	4	7	13	10	8	11	10	17	3	12
1873	10	15	6	15	11	14	6	10	9	13	8	8
1874	15	14	2	5	15	12	4	7	14	9	7	9
1875	10	13	8	15	12	16	3	10	8	13	9	8
1876	12	15	4	10	14	14	3	7	9	8	13	11
1877	18	11	2	8	11	13	7	1	11	13	6	7
1878	7	15	9	10	12	16	3	15	11	13	6	10
1879	15	12	4	7	10	16	5	7	8	17	5	12
1880	12	18	1	9	13	11	7	14	13	9	8	11
1881	17	8	6	10	15	13	3	4	8	16	6	13
1882	13	9	9	13	9	17	5	16	13	14	3	6
1883	13	11	7	11	16	10	5	4	14	12	4	8
1884	5	25	1	12	15	12	4	9	15	9	6	8
1885	9	20	2	13	8	18	5	13	13	8	9	9
1886	18	11	2	6	8	19	4	11	11	11	8	13
1887	18	11	2	10	14	10	7	9	7	11	12	14
1888	11	8	12	11	9	11	11	9	13	9	8	6
1889	14	8	9	12	15	11	5	7	8	11	11	7
1890	13	17	1	5	12	10	9	10	9	12	9	7
1891	13	13	5	8	10	14	7	10	20	9	1	4
Sum	274	274	103	205	258	277	116	192	240	243	147	187
Mean	13.0	13.0	4.9	9.8	12.3	13.2	5.5	9.1	11.4	11.6	7.0	8.9

Year.	October.				November.				December.			
	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.	Clear.	Fair.	Cloudy.	Rainy.
1871	......	......	......	......	8	7	15	12	14	7	10	10
1872	18	10	3	3	8	10	12	11	5	14	12	9
1873	8	13	10	12	4	9	17	11	8	9	14	10
1874	10	13	8	9	10	10	10	12	7	14	10	7
1875	8	9	14	13	5	13	12	10	5	11	15	13
1876	13	9	9	9	2	6	22	12	5	13	13	13
1877	1	17	13	14	3	6	21	14	6	8	17	14
1878	7	14	10	13	8	15	7	10	9	9	13	19
1879	5	20	6	10	4	12	14	12	3	14	14	17
1880	11	11	9	10	12	7	11	9	6	10	15	13
1881	6	12	13	17	7	13	10	12	10	11	10	9
1882	11	14	6	12	3	14	13	14	9	10	12	14
1883	6	8	17	19	14	7	9	9	9	15	7	11
1884	14	11	6	10	9	14	7	9	4	9	18	18
1885	8	13	10	11	4	13	13	12	8	15	8	15
1886	19	4	8	7	10	10	10	10	8	12	11	12
1887	12	10	9	8	11	8	11	7	4	7	20	13
1888	9	11	11	11	8	6	16	11	9	5	17	9
1889	14	7	10	7	5	9	16	17	10	9	12	10
1890	4	9	18	15	11	7	12	8	10	10	11	8
1891	13	11	7	5	6	5	19	11	11	9	11	9
Sum	197	226	197	215	152	201	277	233	160	221	270	253
Mean	9.8	11.3	9.8	10.8	7.2	9.6	14.1	11.1	7.6	10.4	12.9	12.0

SUMMARY.

Month.	Clear.	Fair.	Cloudy.	Rainy.	Month.	Clear.	Fair.	Cloudy.	Rainy.
January	144	260	247	252	July	274	274	103	205
February	165	220	207	229	August	258	277	116	192
March	153	265	233	251	September	240	243	147	187
April	169	249	182	220	October	197	226	197	215
May	230	236	185	245	November	152	201	277	23[illegible]
June	164	302	164	241	December	160	221	270	[illegible]

In order to determine whether we have to deal with a lake influence in these conditions of clouds and rain, I have instituted a comparison between the same data at the three lake stations, Chicago, Milwaukee, and Grand Haven. These results are given in Table XLVIII and show that in the main it is the lake that causes these conditions on all sides. The cloudiness at Grand Haven during the colder months is phenomenal.

TABLE XLVIII.—*Clear, fair, cloudy, and rainy days at Chicago, Milwaukee, and Grand Haven*, 1871–1890.

Month.	Clear.			Fair.			Cloudy.			Rainy.		
	Chicago.	Milwaukee.	Grand Haven.	Chicago.	Milwaukee.	Grand Haven.	Chicago.	Milwaukee.	Grand Haven.	Chicago.	Milwaukee.	Grand Haven.
January	7.0	5.6	1.5	13.3	14.5	8.2	10.7	10.9	21.3	12.2	13.1	20.0
February	7.9	5.9	4.0	11.2	12.4	10.2	9.2	10.0	14.1	10.7	10.1	13.4
March	6.9	6.7	5.0	12.9	13.5	13.3	11.2	10.8	12.7	12.1	12.1	13.7
April	7.9	6.7	8.0	12.9	13.7	12.6	9.2	9.6	9.4	11.3	10.7	10.5
May	11.0	9.3	11.2	11.7	13.2	12.3	8.3	8.5	7.5	11.6	11.4	11.5
June	8.0	7.3	9.7	14.7	16.2	13.8	7.3	6.5	6.5	11.3	11.7	9.1
July	12.7	10.2	13.4	13.2	16.2	13.5	5.1	4.6	4.1	10.6	10.8	8.6
August	12.1	10.1	13.0	13.7	14.9	13.2	5.2	6.0	4.8	9.7	9.2	9.1
September	11.2	9.0	10.2	11.8	13.8	12.4	7.0	7.2	7.4	9.4	10.7	10.8
October	9.9	7.3	7.9	11.8	13.1	10.4	9.3	10.6	12.7	10.4	9.9	12.3
November	7.1	5.4	3.6	10.1	11.8	9.2	12.8	12.8	17.2	11.1	10.3	14.5
December	6.6	5.4	1.4	11.2	12.5	7.5	13.2	13.1	22.1	12.6	18.5	17.2

DIRECTIONS OF WINDS AND CLOUDS.

It has been a mooted question in Europe as to the relative directions of the winds and clouds. In this country it has been found that the two have the same direction, in general, or, when they differ, the clouds have a tendency to move in the general upper current to the east. It was thought of some interest to inquire whether this law holds good at Chicago or whether the lake caused a divergence.

Table XLIX exhibits a summary of observations for the 14 years, 1878–1891. We see that during 56 per cent. of the observations the direction of the clouds was the same as that of the wind; for 24 per cent. they differed 45°; 9 per cent., 90°; 7 per cent., 135°; and 4 per
., 180°. Or, we may say that in 80 per cent. of the cases the
tion was practically the same with both. It was noted that the
which did not follow the rule were often light and influenced
lake.

TABLE XLIX.—*Clouds and winds, Chicago.*

SAME DIRECTION.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Sum.	Mean
January	24	16	4	8	19	10	17	7	11	25	53	41	25	28	288	20.6
February	24	9	14	13	10	14	33	16	11	46	50	15	17	27	299	21.4
March	37	17	19	7	21	24	30	34	17	58	63	10	24	49	410	29.3
April	33	6	27	2	22	13	23	11	13	51	33	27	17	21	299	21.4
May	19	10	15	5	25	17	10	13	9	48	30	36	29	14	280	20.0
June	23	11	13	8	16	22	7	21	11	49	32	24	21	13	271	19.4
July	19	14	10	4	14	16	13	17	9	60	20	24	15	8	243	17.4
August	13	19	18	12	21	11	10	20	15	69	33	22	15	13	291	20.8
September ..	23	18	23	18	24	13	8	31	20	54	18	22	13	13	298	21.3
October......	20	19	34	26	21	21	15	25	17	55	43	36	36	21	389	27.7
November...	19	24	16	23	25	13	15	22	15	55	47	38	35	28	375	26.8
December ...	29	9	8	10	17	27	13	7	16	62	53	39	35	21	346	24.7
Total	283	172	201	136	235	201	194	224	164	632	475	334	282	256	3,789	22.6

DIFFERING 45°.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Sum.	Mean
January	5	11	5	6	4	6	9	13	3	19	6	7	8	10	112	8.0
February	9	4	8	3	2	10	5	8	10	10	6	8	10	15	108	7.7
March	9	4	8	4	3	7	3	7	8	4	8	11	7	4	87	6.2
April	14	9	6	6	6	8	8	16	11	8	3	7	14	15	131	9.4
May	9	7	3	8	10	13	14	16	11	8	7	15	13	11	145	10.4
June	11	10	11	6	10	9	12	11	7	10	6	13	14	12	142	10.1
July	10	8	11	11	17	8	11	13	9	5	14	5	15	10	147	10.5
August	7	10	2	11	10	7	12	17	11	2	20	8	20	15	152	10.9
September ..	13	10	5	12	10	9	17	7	20	4	12	14	24	11	168	12.0
October......	9	12	5	7	9	11	13	12	19	3	11	14	15	15	155	11.1
November...	6	3	11	3	6	13	12	19	27	0	8	11	11	25	155	11.1
December ...	9	1	5	6	8	5	10	8	9	6	11	6	11	18	113	8.1
Total	111	89	80	83	95	106	126	147	145	79	112	119	162	161	1,615	9.6

DIFFERING 90°.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Sum.	Mean
January	1	4	1	1	3	1	1	3	1	8	1	0	3	1	29	2.1
February	1	3	1	2	0	3	1	2	1	1	4	1	1	1	22	1.6
March	3	4	6	5	3	4	2	3	2	1	1	4	4	6	48	3.4
April	4	5	10	3	2	5	2	3	4	2	4	0	7	4	55	3.9
May	5	5	6	3	2	5	3	7	6	2	6	4	3	8	65	4.6
June	5	8	3	6	7	1	3	5	5	6	6	5	10	11	81	5.8
July	5	2	6	6	7	7	7	3	5	1	9	1	11	6	76	5.4
August	9	2	7	2	4	3	8	6	9	3	3	0	18	8	82	5.9
September ..	3	0	4	1	0	1	3	2	5	2	4	4	14	7	50	3.6
October......	4	3	3	2	4	4	6	8	10	0	1	0	6	4	55	3.9
November...	6	0	3	1	5	2	4	3	14	0	1	0	6	1	46	3.3
December ...	0	0	2	0	2	0	2	2	14	0	0	0	4	10	36	2.6
Total	46	36	52	32	39	36	42	47	76	26	40	19	87	67	645	3.8

DIFFERING 135°.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Sum.	Mean
January	0	0	0	2	0	1	1	0	0	1	2	0	0	0	7	0.5
February	3	1	1	3	1	2	0	2	0	2	0	1	3	3	22	1.6
March	2	4	3	2	2	8	1	2	1	1	2	1	4	3	37	2.6
April	3	2	4	4	6	4	0	2	6	2	4	0	7	4	45	3.2
May	2	9	4	3	1	4	2	3	9	3	5	0	8	7	60	4.3
June	4	8	2	8	9	2	2	6	11	2	4	0	10	5	73	5.2
July	12	2	3	3	5	1	6	3	10	3	2	4	6	12	72	5.1
August	8	4	2	4	3	4	3	2	19	0	5	1	8	4	67	4.8
September ..	2	4	3	4	1	1	5	0	9	1	2	0	6	1	39	2.8
October......	3	0	2	2	7	2	3	0	7	0	1	1	4	1	33	2.4
November...	1	0	0	1	2	1	1	1	1	0	2	0	1	0	11	0.8
December ...	0	0	2	1	1	0	1	0	2	0	0	1	1	3	12	0.9
Total	38	34	26	37	38	30	25	21	75	15	29	9	58	43	478	2.8

TABLE XLIX.—*Clouds and winds, Chicago*—Continued.

DIFFERING 180°.

Month.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	Sum.	Mean
January	2	2	0	0	0	1	0	1	0	1	1	0	0	0	8	0.6
February	1	0	0	1	0	0	0	0	0	1	2	0	0	0	5	0.4
March	1	3	0	1	3	2	1	0	0	3	0	1	1	3	19	1.4
April	0	0	0	2	4	3	0	0	0	1	3	1	1	0	15	1.1
May	0	2	1	1	2	3	2	1	2	0	0	1	3	0	18	1.3
June	2	2	0	3	3	0	2	5	5	5	4	1	4	10	46	3.3
July	3	4	3	0	2	3	4	0	3	1	8	1	7	3	42	3.0
August	5	5	3	1	2	0	4	5	1	1	6	0	6	4	43	3.1
September	0	2	4	0	1	0	1	3	2	3	4	1	4	1	26	1.9
October	3	2	0	1	3	2	1	0	1	0	0	0	3	0	16	1.1
November	0	0	0	0	0	0	1	0	6	0	0	0	0	0	7	0.5
December	0	0	0	0	0	0	0	1	2	1	0	0	0	0	4	0.3
Total	17	22	11	10	20	14	16	16	22	17	28	6	29	21	249	1.5

SUMMARY.

	Same.	45°.	90°.	135°.	180°.	Total.
Total	3,789	1,615	645	478	249	6,776
Per cent	56	24	9	7	4	100

OCCURRENCE OF FOGS.

Table L gives the number of fogs which have been recorded during the 17 years from 1872 to 1888, inclusive. It will be seen that by far the largest number occurred during the morning, 72 per cent., while the least number were recorded in the afternoon, 8 per cent. This was to be expected, as the relative humidity is highest in the morning and lowest in the afternoon.

TABLE L.—*Fogs at Chicago by hours.*

Year.	January.			February.			March.			April.			May.			June.			July.		
	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.
[illegible]	0	1	0	1	0	1	0	0	0	0	0	0	....	....	....	....	....	....	2	0	0
[illegible]	4	0	0	1	0	1	0	0	0	1	0	1	2	0	0	1	1	1	2	1	0
[illegible]	2	0	0	1	0	0	1	1	0	1	0	0	0	0	0	1	0	1	0	0	0
[illegible]	1	0	0	0	0	0	5	0	0	0	0	0	1	0	1	1	3	1	1	0	1
[illegible]	1	1	0	1	0	1	0	0	0	1	0	1	1	0	1	2	0	1	2	0	0
[illegible]	2	0	2	1	0	2	0	0	1	1	1	2	0	0	0	0	0	0	0	0	0
[illegible]	3	0	0	4	0	0	6	0	1	1	1	0	0	0	0	0	0	0	0	0	0
[illegible]	6	0	1	0	0	0	3	0	0	3	0	0	0	0	0	0	0	0	1	0	0
[illegible]	4	2	3	2	1	1	4	0	0	0	0	0	0	0	0	0	0	0	2	0	0
[illegible]	4	0	1	5	1	1	4	0	0	3	0	0	1	0	1	1	0	1	0	0	0
[illegible]	4	0	1	1	1	1	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0
[illegible]	1	0	0	1	0	0	1	0	0	....	....	....	....	....	....	....	....	....	....	....	....
[illegible]	....	....	....	1	1	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0
[illegible]	....	....	....	....	....	....	....	....	....	....	....	0	0	1	0	0	1	2	0	0	1
[illegible]	1	1	1	1	3	2	0	0	0	1	0	1	2	0	0	....	....	....	....	....	....
[illegible]	....	....	....	....	....	....	....	....	....	1	0	0	0	0	2	1	0	1	....	....	....
[illegible]			1	4	0	2	0	0	0	1	0	1	0	0	0	1	0	0	2	0	0
			10	24	7	13	24	1	2	14	2	6	10	1	6	8	5	9	13	1	2

TABLE L.—*Fogs at Chicago by hours*—Continued.

Year.	August.			September.			October.			November.			December.			Annual.		
	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.	7.	15.	23.
1872	2	0	0	1	0	1	6	0	3	6	0	1	4	1	1	22	2	7
1873	1	0	0	0	0	0	2	0	0	3	0	0	1	0	0	18	2	3
1874	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	8	1	1
1875	1	0	3	1	0	1	1	0	0	0	0	0	2	2	2	14	5	9
1876	1	0	1	1	0	3	1	0	4	0	0	3	1	0	0	12	1	15
1877	3	0	0	8	0	0	17	2	1	6	1	1	5	0	3	43	4	12
1878	1	0	0	5	0	1	6	0	0	8	1	2	5	0	0	39	2	4
1879	2	0	0	0	0	0	5	0	1	1	0	0	1	0	0	22	0	2
1880	0	0	0	2	0	1	1	0	1	3	0	0	2	0	0	20	3	6
1881	0	0	0	2	0	2	2	0	0	2	0	0	1	1	0	25	2	6
1882	5	1	0	0	0	0	1	0	0	1	0	1	1	0	0	15	2	4
1883	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	3	0	0
1884	....	....	....	....	....	....	....	....	....	2	0	0	0	1	0	5	2	2
1885	0	0	....	....	....	....	....	....	....	2	0	0	3	0	0	5	2	3
1886	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	5	4	4
1887	....	....	....	3	0	0	1	0	0	3	1	1	0	0	0	9	1	4
1888	4	0	0	7	0	0	9	0	1	12	0	0	9	1	0	50	3	5
Total	20	1	4	30	0	9	54	2	11	49	3	9	35	6	6	315	36	87

In Table LI is a summation of the records by the total number of fogs in each month and year from 1872 to 1891. During the last three years there were no observations in the afternoon, and the observations at night were made about three hours earlier than previously. It will be noted that by months the colder season has much the greater amount of fog, and this is largely due to the fact that the relative humidity is much greater then, though this does not account for the superabundance of fog in September and October, or at the time the temperature gradually diminishes.

In this table there is a rather remarkable fluctuation in the amount of fog during different years. A minimum of 10 being recorded in 1874, and of 3 in 1883, while a maximum of 59 was recorded in 1877, and of 60 in 1888.

TABLE LI.—*Summary of fogs at Chicago.*

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872	1	2	0	0	0	0	2	2	2	9	7	6	31
1873	4	2	0	2	2	3	3	1	0	2	3	1	23
1874	2	1	2	1	0	2	0	0	0	2	0	0	10
1875	1	0	5	0	2	5	2	4	2	1	0	6	28
1876	2	2	0	2	2	3	2	2	4	5	3	1	28
1877	4	3	1	4	0	0	0	3	8	20	8	8	59
1878	3	4	7	2	0	0	0	1	6	6	11	5	45
1879	7	0	3	3	0	0	1	2	0	6	1	1	24
1880	9	4	4	0	0	0	2	0	3	2	3	2	29
1881	5	7	4	3	2	2	0	0	4	2	2	2	33
1882	5	3	0	0	2	1	0	6	0	1	2	1	21
1883	1	1	1	0	0	0	0	0	0	0	0	0	3
1884	0	3	0	0	5	3	1	0	1	1	5	1	20
1885	0	1	1	0	4	1	2	1	0	6	5	9	30
1886	6	6	1	8	3	3	2	2	0	2	1	4	38
1887	0	2	0	1	2	5	0	0	3	1	5	0	19
1888	4	6	2	2	0	1	2	4	7	10	12	10	60
1889	8	0	6	5	0	8	1	7	2	5	4	4	50
1890	7	5	1	2	3	3	0	0	0	4	4	5	34
1891	4	4	2	0	0	7	0	1	12	6	4	6	46
Total.	73	56	40	35	27	47	20	36	54	91	80	72	

Table LII was constructed in order to enable a comparison between the records at the three stations, Chicago, Grand Haven, and Milwaukee. It will be noticed that great irregularity occurs in the records at these stations; 1883 shows 36 cases at Grand Haven and only one at Milwaukee. A large part of these discrepancies is due to the change of observers and a lack of uniformity in making a record of fogs. The large increase of 60 in 1888 at Chicago, and of 50 in 1889, is due, in all probability, to the counting of more light fogs, for the records at the other two stations do not show any such increase in these years.

TABLE LII.—*Summary of fogs at Chicago, Grand Haven, and Milwaukee.*

Years.	Chicago.	Grand Haven.	Milwaukee.
1875	28	25	....
1876	28	36	....
1877	59	36	....
1878	45	12	....
1879	24	15	....
1880	29	2	....
1881	33	5	1
1882	21	22	1
1883	3	36	1
1884	20	30	34
1885	30	27	29
1886	38	22	25
1887	19	10	15
1888	60	26	32
1889	50	36	30

An important question arises in this connection as to the influence of smoke on fog production. It is thought, in many quarters, that fog is largely due to the abundance of carbon or smoke particles in the air, and that each fog particle has a nucleus of a smoke or dust particle. In this way the great prevalence of fog in London has been accounted for. An attempt has been made to obtain from the observations some idea of the prevalence of smoke and its gradual increase from year to year, but the records do not seem to be very complete. In 1883 smoke was reported at Chicago once; in 1884, 4 times; 1885, 18; 1886, 60; 1887, 87; in the first four months of 1888, 32 were recorded; and in the last eight only 3 records were made; in 1889 and 1890 *no* reports were made. It seems probable that it was decided not to record it, as being a purely local phenomenon and not existent outside of the immediate environment of the city. The actual amount of smoke at Chicago has increased within a year, and at the present day it is probable that more than two-thirds of the time there is a more or less dense smoke over the city. It would appear, then, as though this would be a most excellent opportunity for testing the question of the prevalence of fog concomitant with he increase of smoke.

The greatest number of fogs recorded in 20 years, with one excep-, was 59 in 1877. From Table XLIX it will be seen that, with xception of the years 1888 and 1889 (during which there were, probably, very light fogs recorded), there is no indication of an increase in the frequency of fogs during the marked increase of smoke. This is especially shown by comparing the years from 1875 to 1878 with those from 1885 to 1891. Even if we count in the abnormal years 1888 and 1889 there are still 40 fogs per year in each of these periods.

THE CAUSE OF FOG.

A study of the weather conditions prevailing at the time of and just before a fog has shown that fog is most likely to prevail in the south or south-southeast quadrant of a low area. At such a time the air is very nearly saturated with vapor, and if the wind should die down and the clouds break away there would be a strong radiation from the earth and air to the sky. The cooling brought about in this way lowers the temperature sufficiently to produce fog. In every instance examined these were the conditions, but it was not found that the direction of the wind had any marked influence, in fact, the direction of the wind is generally toward the lake during fog. From this discussion we easily see why it is that a dense fog is almost always a good indication of clearing weather.

THUNDER AND SEVERE LOCAL STORMS.

The observation of thunderstorms has been somewhat irregular, and different observers seem to have fixed their own system of making the records.

Table LIII gives a summary of the storms by months and years, and Table LIV gives them collected in two classes according to severity.

TABLE LIII.—*Thunderstorms of Chicago, by months.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
1871	......	......	1	3	4	4	5	5	......	......	......	......	22
1872	......	......	1	2	6	6	5	1	1	......	......	......	22
1873	......	......	......	1	4	2	5	......	......	......	......	......	12
1874	......	......	3	......	1	2	......	......	......	......	......	......	6
1875	......	......	2	......	......	......	2	......	......	......	......	......	4
1876	......	......	......	......	......	3	2	......	......	......	......	......	5
1877	......	......	1	3	......	5	2	......	1	......	......	......	12
1878	......	......	2	1	1	2	......	2	2	1	......	......	11
1879	......	......	2	......	2	......	1	......	......	......	......	......	5
1880	......	......	2	6	9	1	10	7	2	2	......	......	39
1881	......	......	......	......	4	6	7	1	5	2	1	......	26
1882	......	......	3	8	2	8	3	12	1	3	......	......	40
1883	......	1	......	6	3	1	5	2	......	1	2	......	21
1884	......	......	......	1	3	5	5	2	1	2	1	......	20
1885	......	......	......	......	6	5	9	8	1	......	1	......	30
1886	......	......	1	4	6	5	4	4	4	1	......	......	29
1887	1	......	......	3	4	3	8	4	2	2	......	......	27
1888	......	......	......	1	6	4	6	5	2	2	2	......	28
1889	1	......	1	3	7	6	6	4	1	1	......	1	31
1890	1	1	1	4	5	15	4	3	2	1	......	......	37
1891	......	1	1	2	2	6	4	4	2	......	......	......	22
Sum	3	3	21	48	75	89	93	64	27	18	7	1	449
Mean	0.1	0.1	1.0	2.3	3.6	4.2	4.4	3.0	1.3	0.9	0.3	0	1.7

TABLE LIV.—*Thunderstorms of Chicago, by years.*

Year.	Light.	Heavy.	Total.
1871	10	12	22
1872	13	9	22
1873	5	7	12
1874	3	3	6
1875	1	3	4
1876	4	1	5
1877	7	5	12
1878	4	7	11
1879	2	3	5
1880	32	7	39
1881	18	8	26
1882	30	10	40
1883	17	4	21
1884	13	7	20
1885	17	13	30
1886	21	8	29
1887	18	9	27
1888	20	8	28
1889	23	8	31
1890	27	10	37
1891	15	7	22
Sum	300	149	....
Mean	14.3	7.1	21.4

There seems to have been a pretty well marked minimum during 1875–1879 which was near a sun spot minimum, and the same fact has been noticed in other series of records, although in Europe it has been commonly considered that the minimum of thunderstorms comes with a maximum of sun spots. July is the month having the greater number, 4.4 in each year, and June comes next with 4.2.

Sometimes with such storms there comes a very high wind, as, for example, the wind that blew down the Young building on April 1, 1892. The severest of these local storms on record occurred on May 6, 1876; the record is that this storm moved from southwest to northeast, accompanied by rain, thunder, and lightning; bounding like a ball, it reached the ground but two or three times. The loss of property was estimated at $250,000. There have been other high winds which have wrought havoc, as, for example, the wind that wrecked some of the World's Fair buildings quite recently. These high winds, or "wind rushes," should be carefully distinguished from the tornado proper, which, so far as known, has visited Chicago but once.

DIURNAL VARIATION OF AIR PRESSURE.

On pp. 52 and 53 are given records from the barograph for the years 1890 and 1891. These are graphically presented in Fig. 23, and for purposes of comparison there are given similar curves for Atlanta, Ga., from February–August. We note the characteristic double maximum and minimum points in all the curves. The principal naximum is later in the colder than in the warmer months, and the rincipal minimum is correspondingly earlier at both stations. There pears also a slight tendency to a greater amplitude of the variation in the colder months than in the warmer, while at Atlanta it is just

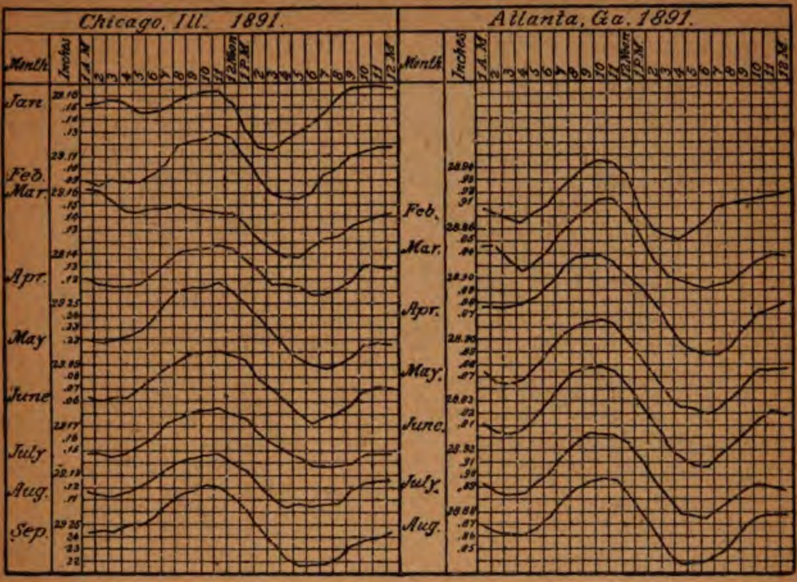


FIG 23.—*Diurnal variation of air pressure.*

the reverse. Ordinarily the increase in moisture diminishes the amplitude.

STORM WARNINGS.

It may not generally be known that the first storm warning of the Signal Service was issued from Chicago. It was as follows:

> CHICAGO, *November* 8, 1870—*Noon.*
>
> A high wind all day yesterday at Cheyenne and Omaha. A very high wind reported this morning at Omaha. Barometer falling, with high wind at Chicago and Milwaukee to-day. Barometer rising and thermometer rising at Chicago, Detroit, Toledo, Cleveland, Buffalo, and Rochester. High winds probable along the lakes.

This was abundantly justified. It was prepared mainly by Prof. I. A. Lapham, who was then in the employ of the Signal Service.

WEATHER PREDICTIONS.

With the multiplication of the weather maps, there is an increased desire for information as to rules for predicting the weather. It is not an easy matter to give definite rules, for the reason that the conditions are so diverse. The occurrence of rain is dependent upon the direction of the wind in winter, a lake wind carrying relatively warm and moist air to the cooler land has its moisture condensed. On the other hand, if the wind is seen to be likely to shift to the lake in the warm months it is rather a sign of clearing weather.

In winter the path of a storm to the southward of the city tends to cause north winds and much lower temperature. A storm to the north will give higher temperature in its front, but if rapidly moving, the northwest wind will be very cold, especially if a high area follows the storm.

In summer a very high temperature with a low pressure area to the west or southwest is likely to give thunderstorms and squalls.

We have no well marked types of weather such as are so prominent in Europe, where often the same kind of weather will be experienced for a week or ten days. There are, however, oftentimes persistent conditions of pressure in the atmosphere which may tend to repeat abnormal cold or warm spells for a month or more. The best way to show this will be to give charts of isobars for the coldest and warmest months since the work of the Weather Service began.

Fig. 24 is a chart of the weather conditions for the month of January, 1888, which recorded the lowest temperature of the 22 Januarys, and Fig. 25, in like manner, exhibits the opposite conditions during the warmest February (1882) of the series. The latter is a remarkable culmination of a series of high monthly temperatures beginning with the previous August. The amount above normal for each month being as follows: August, +5.5°; September, +7.4° (highest on record); October, +5.2°; November, +2.7; December, +9.9°; January, +4.3°; February, +12.0° (highest on record).

In Fig. 24 we have the usual distribution of pressure which occurs with low temperatures in the Northwest. A marked area of high pressure in the Missouri Valley showing that a series of high areas with accompanying cold waves had moved in succession from the north to the south and southeast, causing the abnormal low temperature. Also, we note the absence of the permanent high area in the southeast and the presence of a well marked low pressure area in the extreme northeast, both of these would have a tendency to cause greater velocity in the northwest winds and an increase of cold.

In Fig. 25 we see just the opposite effect. The high pressure is now seemingly kept back by the Rocky Mountain range. An area of relatively low pressure to the north and of marked high pressure in the southeast states also aid in keeping up the temperature. These figures may be regarded typical to these two opposite kinds of weather. When we see a rather persistent high pressure area in the plateau region we may be sure there will not be severe cold experienced in the Lake region. What determines the movement of ese high areas has never been determined. Possibly a tendency to e descent of Arctic cold in British America may be a cause, but this simply removing the difficulty one step back.

RELATIVE STORM FREQUENCY.

rofessional Paper No. XIV are given charts of relative frequency ns, and from these are taken the following figures showing the

B.

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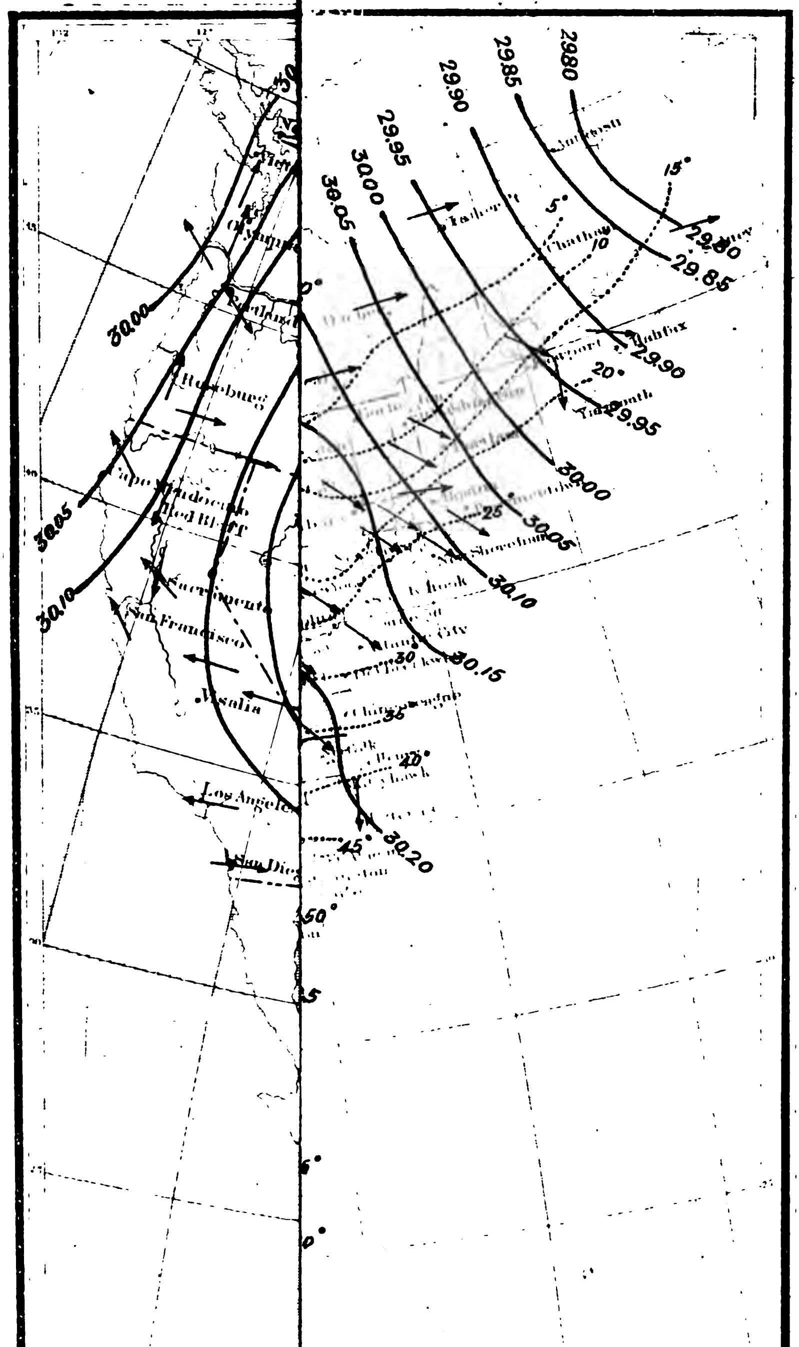
29.80
29.85
29.90
29.95
30.00
30.05
30.10
30.15
30.20
5°
10
15°
20°
25
30
35
40°
45
50°
Olympia
Portland
Roseburg
Cape Mendocino
Red Bluff
Sacramento
San Francisco
Visalia
Los Angeles
San Diego
Chatham
Halifax
Yarmouth
Atlantic City

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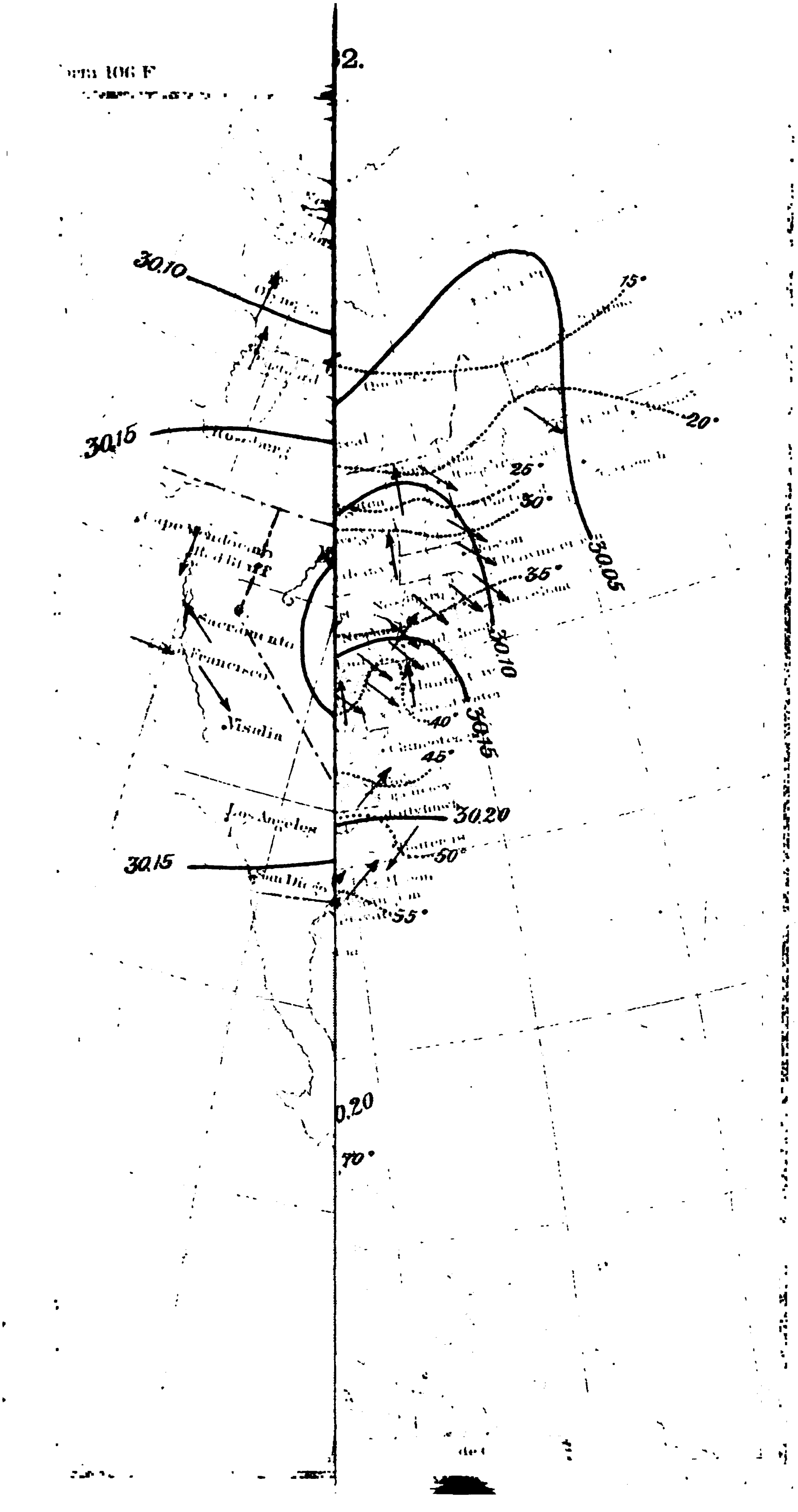
30.10
30.15
15°
20°
25°
30°
35°
30.05
30.10
Red Bluff
Sacramento
San Francisco
Visalia
40°
30.15
45°
Los Angeles
30.20
50°
30.15
San Diego
55°
0.20
70°

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ASTOR, LENOX AND
TILDEN FOUNDATIONS.

number of storms passing over each 5° square near Chicago, or within about 170 miles of the city.

This takes no account of the large number of storms passing more than 170 miles away from which precipitation would occur at the city.

TABLE LV.—*Number of storms near Chicago.*

Month.	Number of storms.	Month.	Number of storms.
January	6 to 8	August	2 to 4
February	4 to 6	September	2 to 4
March	4 to 6	October	4 to 6
April	2 to 4	November	6 to 8
May	4 to 6	December	4 to 6
June	2 to 4		
July	2 to 4	Year	36 to 48

ARE THE SEASONS CHANGING?

This is a very frequent question, and we find frequent allusions to the fact that the temperature is gradually rising, that rains are becoming less abundant, etc. To all this it may be said that the most accurate observations of temperature for more than 100 years at many places in Europe have not shown any such effect.

At Chicago we have just seen that the lowest January temperature, 15.1° (8.9° below normal), occurred in 1888. In examining Table XIX, which gives approximately the mean temperature for 62 years, we see that the mean from 1850–1870 is 1.3° lower than that from 1871–1891; but I have already shown reasons for thinking the former a little too low and the latter too high. The highest annual temperature of the whole series was 53° in 1846. We are entirely safe in assuming that the temperature shows no change in the seasons as a whole. Whether spring is a little earlier now than formerly is a slightly different question, and there are some indications of this.

It was hoped that the indigenous forest growth along the lake would give some idea as to the cumulative effect through hundreds of years of the increased temperature and moisture due to the lake, but diligent inquiry failed to demonstrate any marked effect of this kind. It is quite well known that in the spring of the year the blossoming of flowers on the lake shore is somewhat retarded, oftentimes the season is ten days or a fortnight later than 12 or 15 miles in the interior.

FREEZING OF THE LAKE.

The lake keeps open in the center all the cold season. In the winter of 1874–1875 ice was cut 16 inches thick two or three miles out on the lake, but this is a rare occurrence.

IS THE WATER LEVEL OF LAKE MICHIGAN GRADUALLY LOWERING?

The level of Lake Michigan has reached a stage a little (.16 foot) below the lowest average stage known, that of 1847, and, under the influence of a southerly wind, it has recently gone two feet below the 1847 stage. This remarkable diminution has been commonly ascribed to the great scarcity of rainfall during the past few months. Its serious aspect is shown in the great difficulty, at times, in keeping up the water supply for the city of Chicago, and if there is to be a steady diminution in the level it will necessitate, not many years hence, a radical change in the methods of obtaining this supply. It becomes then of the extremest importance to determine, if possible, whether there has been such a diminution in the lake level through some means other than the scarcity of rainfall, and whether this diminution is likely to continue in years to come.

It is commonly accepted among meteorologists that the rainfall of the earth has remained practically constant for more than 100 years, that is, while there may be a scarcity in some years this will be entirely made up in succeeding years, or, in other words, there is no permanent change in the total rainfall reaching the earth. It is interesting to test this question in respect to the watershed of Lakes Michigan and Huron. The condition of rainfall about Lake Superior, or its water level, does not enter the problem directly, since its height is 602 feet, while that of Huron and Michigan is 582 feet.

An examination of the precipitation records reveals many serious errors, especially in the measurement of snow previous to 1885. The records of voluntary observers, on whom alone we can rely previous to 1871, are also far from satisfactory. However, there is a fair probability that while the absolute amount of precipitation cannot be determined, the relative amount from year to year may be regarded as approximately correct. There is also a slight difficulty in that very few of the records were begun in 1852. Five stations were selected as giving the longest records and fairly well distributed over the watershed. These are Chicago, Milwaukee, Detroit, Marengo, and Peoria, which is near the watershed. The rainfall records from these stations have been combined and then smoothed out by taking the consecutive 5-year means. Table LVI gives the total smoothed rainfall from 1853 to 1891.

TABLE LVI.—*Rainfall at Chicago, Milwaukee, Detroit, Marengo, and Peoria by years.*

Year.	Amount.	Year.	Amount.	Year.	Amount.
	Inches.		*Inches.*		*Inches.*
	33.4	1865	30.7	1878	37.7
	33.2	1866	31.7	1879	37.9
	33.1	1867	33.9	1880	37.1
	37.2	1868	32.7	1881	36.8
	36.6	1869	32.1	1882	37.2
	34.0	1870	33.4	1883	36.6
	35.0	1871	33.1	1884	33.8
	36.0	1872	30.8	1885	32.7
	33.1	1873	32.7	1886	31.4
	32.7	1874	34.6	1887	30.5
	33.3	1875	36.0	1888	31.2
	33.4	1876	36.5	1889	30.4
		1877	37.5		
	[illegible]4.2	Mean	33.5	Mean	34.5

The most serious discrepancy that has been found has been in the records at Marengo. Mr. Schott gives the following precipitation records at Marengo and Riley, which are about 3 miles apart:

TABLE LVII.—*Rainfall at Marengo and Riley.*

Year.	Marengo.	Riley.
	Inches.	*Inches.*
1863	25.57	40.46
1864	23.91	46.90
1865	30.71	49.90

According to these records there is a difference of over 19 inches in the annual precipitation at two stations only 3 miles apart, which is remarkable. There is also a record of 71.0 inches at Detroit during 1855, which seems excessive. However, these irregularities are partially smoothed out by taking the five stations together, and it would seem as though the fluctuation in the annual rainfall is quite closely indicated by these observations. The records have been divided into three groups, from 1853–1864, 1865–1877, and 1878–1889, and the means of the three are 34.2 inches, 33.5 inches, and 34.5 inches, respectively. It will be seen that the average 12 years precipitation is greatest in the last set. I have also computed the smoothed observations of lake level at Chicago and Milwaukee, and the rainfall by months at Chicago in two groups, 1854–1872 and 1873–1891.

On Fig. 26 accompanying, is a graphical representation of these records; *a* shows (in full lines) the lake level at Chicago and (in dotted lines) the level at Milwaukee. There is a most remarkable and satisfactory correspondence between these curves, showing that the effect of the wind, air pressure, and other slight changes in the atmosphere are practically averaged out in yearly records, or are the same at the two stations.

The Chicago lake level up to the end of 1870 was taken in the river, but since 1871 at the "crib," some two miles from shore. There is a very singular effect to be noticed in the lake crib levels at Chicago. Beginning with 1871, the crib curve gradually draws near the Milwaukee curve and crosses it at 1880, and from 1880 to 1891 it gradually draws away from the Milwaukee curve and on the opposite side. This may be due to a gradual rising of the crib through the action of the waves, though we would naturally expect that the crib, if anything, would settle in the lapse of time. Another explanation would be that the bottom of the lake under the crib has very slowly risen. The amount of water pumped from the well has gradually increased from year to year, and this may cause a diminution of the lake level at that point.

The most marked peculiarity in these curves, however, will b found on comparing the broken curve (rainfall over the watershe the lake) with the lake level curve. It will be seen that there b been two marked rises in the lake, one in 1860 and the other in 1 The precipitation curve shows a maximum in 1856, but the w curve is far below the lake level, a second maximum in 1879 is much longer continued than the first, and is very close to the to the lake level maximum in 1884. A portion of this difference be assigned to the rising of the crib zero, but there is still an outsta ing difference of several inches in the effect upon the lake of co

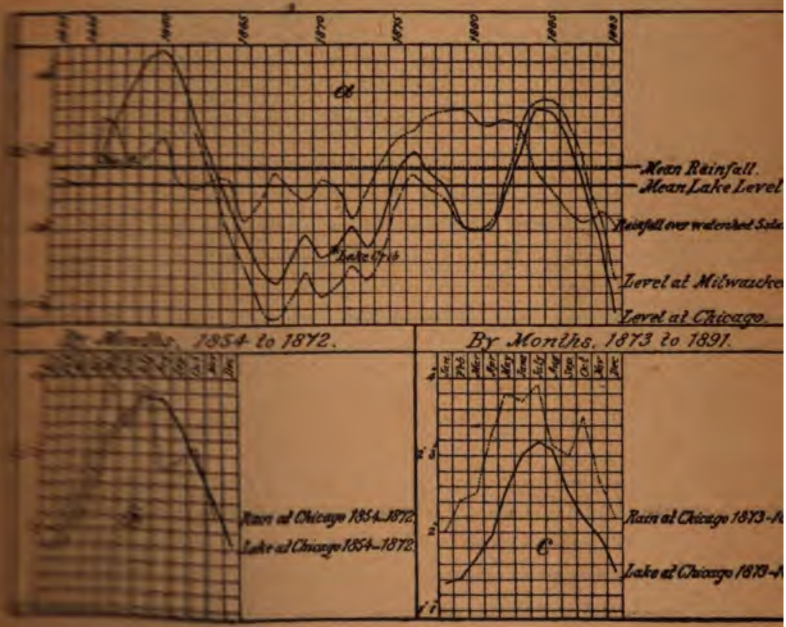

FIG 26.—*Precipitation and lake level.*

[illegible] of precipitation and evaporation, that is, a g [illegible] and snow, considering the evaporation constan [illegible] had a much greater effect in raising the lev [illegible] 1879. A part of this difference may have been [illegible] water stand in 1879, or at the time the water l [illegible] would appear, on the whole, that the only [illegible] some of the difference is on the hypothesis [illegible] rmanent diminution of the lake level of so [illegible] ¼ inch per year.

[illegible] Lakes Michigan and Huron is 44,800 sq [illegible] ring the inflow from Lake Superior as ave [illegible] in a long period of years, and the out [illegible] the precipitation which flows from [illegible] ng a constant quantity, we have betw one-fifth and one-sixth of a cubic mile of water per year that is gradually wasting away.

We may attack the problem from still another standpoint. It is known that centuries ago the level of the lakes was far above their present stand. A high level indicates a greater outflow, and this increased outflow would continue until an exact balance was established between the total precipitation on the lakes and that finding its way to them from the watershed, and the outflow. It is impossible to determine whether such a balance had been reached at the beginning of our records, but we may assume that it had.

There seems to be a gradual diminution of the water level of from $\frac{1}{4}$ to $\frac{1}{3}$ inch per year. This may seem an exceedingly small quantity, but it is large enough to show the necessity of conserving with some care the waters of the lakes. It is proposed to increase the depth of the waterway in the Saint Clair River to 21 feet, and also to cut an enormous waterway from Chicago to the Mississippi. These drains upon the lakes would be a serious factor. When we add to this that the water supply of Chicago draws out nearly one-fifteenth cubic mile per year, we see forcibly the necessity of exercising great care in preserving the natural level of Lake Michigan.

METEOROLOGIC SUMMARY.

There is added a monthly and annual summary of all the official weather observations at this station, Table LVIII. The mean dew-point is given in Table LIX. Table LX shows grains per cubic foot of moisture from 1882 to 1891. Table LXI gives the dates of first and last killing frosts.

ABSTRACT OF JOURNAL.

The daily journal contains a description of all auroral phenomena, violent storms, and other facts of interest transpiring since the occupation of this station by the Weather Service. This has been quoted from quite freely. It has also been deemed advisable to quote the observers' experiences during the great fire of October 8–9, 1871.

H. A. HAZEN.

WASHINGTON, D. C., *June* 27, 1892.

TABLE LVIII.—*Meteorological summary, Chicago,* 1871.

Pressure, 29.″+ Latitude 41° 53′ N., longitude 87° 37′ W. Height of barometer, 824′. *28.″

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
	″	″	″	″	″		″		″	°	°	°	°	°	°	°	°	°		°		°			
Jan	.22	.23	.23	.23	.65	18	8.65	31	1.00	29.1	32.8	30.9	30.9	......	......	......	......	......	......	......	......	......	......	......	......
Feb	.10	.10	.10	.10	.61	10	8.49	17	1.12	29.7	35.6	33.4	32.9	......	......	......	......	......	......	......	......	......	......	......	......
Mar	.05	.02	.04	.04	.42	24	8.41	8	1.01	39.5	45.3	41.2	42.0	......	......	......	......	......	......	......	......	......	......	......	......
Apr	.95*	.89*	.93*	.92*	.48	2	8.41	19	1.07	46.8	56.7	50.8	51.4	......	......	......	......	......	......	......	......	......	......	......	......
May	.15	.10	.13	.13	.56	10	8.86	16	.70	56.2	62.4	56.9	58.5	......	......	......	......	......	......	......	......	......	......	......	......
June	.11	.09	.06	.09	.38	21	8.79	12	.59	......	......	......	66.8	......	......	......	......	......	......	......	......	......	......	......	......
July	.14	.09	.11	.11	.39	23	8.84	6	.55	69.4	76.3	71.0	72.2	......	......	......	......	......	......	......	......	......	......	......	......
Aug	.11	.04	.10	.08	.36	17	8.65	29	.71	69.2	75.9	71.0	72.0	......	......	......	......	......	......	......	......	......	......	......	......
Sept	.32	.26	.29	.29	.62	30	8.98	22	.64	56.0	65.8	59.9	60.6	......	......	......	......	......	......	......	......	......	......	......	......
Oct	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Nov	.19	.17	.18	.18	.58	12	8.68	9	.90	31.9	38.0	34.8	34.9	......	......	......	......	......	......	......	......	......	......	......	......
Dec	.18	.14	.18	.17	.66	27	8.36	23	1.30	18.0	25.0	20.6	21.2	......	......	......	......	......	......	......	......	......	......	......	......
Year	......	......	......	......	.66	....	8.36	....	1.30	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	.01 rain-fall.
													Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
	″	″		%	%	%	%					*Miles.*	*Miles.*															
Jan	4.12	1.20	14	76	71	74	74	7.2	6.0	6.2	6.5	......	......	......	......	5	7	8	2	24	16	15	15	1	7	7	17	12
Feb	1.46	.78	18	68	67	70	68	5.0	4.8	4.5	4.8	......	......	......	......	5	13	9	5	12	17	15	8	0	15	4	9	6
Mar	2.66	.71	3	75	69	74	73	6.2	6.5	3.0	5.2	......	......	......	......	11	14	15	8	10	13	12	10	0	11	13	7	11
Apr	5.70	1.95	11	68	62	68	66	5.8	7.0	4.5	5.8	......	......	......	......	8	13	7	9	10	21	17	5	0	5	15	10	12
May	3.90	1.03	26	74	63	73	70	5.2	5.2	4.5	5.0	6,545	......	......	......	10	28	16	8	9	10	6	6	0	16	3	12	11
June	5.56	2.13	24	....	....	....	....	4.5	5.2	4.5	4.7	6,090	......	......	......	8	19	9	13	9	8	10	11	3	15	9	6	14
July	2.52	1.57	4	73	60	73	....	3.8	4.0	3.6	3.8	6,205	......	......	......	5	17	12	7	13	22	7	6	4	14	10	7	8
Aug	2.01	.73	5	76	66	76	....	4.0	3.2	2.3	3.2	6,025	......	......	......	9	14	16	10	14	12	10	7	1	16	10	5	8
Sept	.74	.50	15	69	55	66	....	3.2	3.7	3.7	3.5	6,540	......	......	......	7	21	11	2	14	18	5	11	1	16	9	5	4
Oct	......	......	....	....	....	....	....	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....
Nov	3.62	1.24	10	78	71	77	....	6.2	6.2	7.0	6.5	......	......	......	......	3	7	13	11	10	14	8	23	1	8	7	15	12
Dec	3.44	2.50	23	84	72	80	....	4.5	5.2	5.2	5.0	8,334	......	......	......	3	2	0	8	17	18	30	15	0	14	7	10	10
Year	......	......	....	....	....	....	....	......	......	......	......	......	......	......	......	....	....	....	....	....	....	....	....	....	....	....	....	....

Meteorological summary, 1872.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A. M.	After-noon.	Night.	Monthly.						A. M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan	.19	.20	.20	.20	.61	1	8.72	19	.89	19.8	26.8	22.4	23.0	......	......	......	......	....	....	......	....	....	......	......	......
Feb	.13	.11	.13	.12	.66	7	8.47	24	1.19	22.0	29.1	25.3	25.5	......	......	......	......	....	....	......	....	....	......	......	......
Mar	.19	.16	.17	.17	.65	20	8.50	30	1.15	25.2	31.2	28.0	28.1	......	......	......	......	....	....	......	....	....	......	......	......
Apr	.10	.07	.09	.09	.56	4	8.45	8	1.11	43.3	52.6	45.8	47.2	......	......	......	......	....	....	......	....	....	......	......	......
May	.11	.06	.11	.09	.47	31	8.60	18	.87	53.4	60.9	53.9	56.1	......	......	......	......	....	....	......	....	....	......	......	......
June ...	.10	.06	.07	.08	.41	21	8.65	7	.76	65.6	75.9	66.1	69.2	......	......	......	......	98	19	51	16	47	0	4	0
July ...	.13	.09	.11	.11	.28	19	8.74	15	.54	70.5	76.5	69.5	72.2	......	63.6	......	......	97	2	52	5	45	0	4	0
Aug	.19	.16	.18	.18	.29	31	8.89	24	.40	68.6	77.1	69.8	71.8	......	63.4	......	......	93	21	56	2	37	0	4	0
Sept ...	.07	.03	.04	.05	.34	1	8.43	28	.91	59.0	70.3	62.4	63.9	......	54.9	......	......	93	6	37	27	56	0	2	0
Oct.....	.23	.17	.21	.20	.57	24	8.60	15	.97	44.8	56.2	49.3	50.1	......	41.8	......	......	81	4	28	11	53	0	0	3
Nov	.17	.14	.16	.16	.50	17	8.76	7	.74	27.8	35.6	31.2	31.5	......	24.2	......	......	59	10	— 2	29	61	9	0	17
Dec	.31	.28	.29	.29	.68	24	8.57	1	1.11	14.4	22.6	19.9	19.0	......	9.4	......	......	46	23	—23	24	69	18	0	31
Year ...	.16	.14	.14	.15	.68	....	8.43	....	1.25	42.9	51.2	45.3	46.5	......	......	......	......	98	....	—23	....	121	......	......	......

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	.01 rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan..........	.68	.29	19	86	76	84	82	5.5	6.0	6.2	5.9	8,123	27	nw.	13	6	4	1	3	11	33	25	10	0	4	17	10	7
Feb..........	.84	.42	5	81	72	78	77	5.8	4.5	4.5	4.9	6,410	37	w.	13	10	21	4	8	17	10	12	4	1	9	10	10	6
Mar	3.79	1.88	30	80	72	78	77	6.2	5.5	3.8	5.2	7,616	34	sw.	18	8	14	3	5	9	16	14	24	0	8	13	10	9
Apr..........	3.03	.63	21	72	56	71	66	5.0	5.0	4.0	4.7	8,466	46	ne.	15	11	13	11	8	11	24	9	2	1	7	11	5	11
May	3.24	.96	29	74	59	74	69	5.5	4.8	4.2	4.8	6,926	25	sw.	26	13	12	9	13	13	10	18	5	0	9	14	8	9
June	3.45	1.21	6	72	53	76	67	5.5	4.5	3.5	4.5	6,266	......	......	......	6	8	13	6	19	19	9	6	4	9	16	5	9
July	3.09	.53	16	77	65	80	74	3.2	5.0	3.1	3.8	6,223	......	......	......	9	20	6	9	7	23	6	10	3	17	10	4	7
Aug	2.59	.89	28	79	62	81	74	4.5	4.2	3.0	3.9	6,776	......	......	......	11	20	4	4	13	26	4	10	1	13	10	8	11
Sept	6.43	2.70	28	75	56	75	69	4.2	4.5	3.2	4.0	8,832	50	......	24	7	9	6	11	18	21	12	4	2	10	17	3	12
Oct	.65	.38	6	72	53	68	64	3.2	3.0	2.5	2.9	7,439	31	......	30	13	10	8	5	16	13	15	10	3	18	10	3	3
Nov	1.06	.77	4	75	63	71	70	4.8	6.0	5.5	5.4	9,057	31	......	13	0	0	2	15	16	28	27	2	0	8	10	12	11
Dec	.22	.07	1	73	66	68	69	5.8	6.0	5.5	5.8	8,325	32	......	14	3	3	3	4	15	23	21	15	6	5	14	12	9
Year..........	29.07	2.70	....	76	63	75	71	4.9	4.9	4.1	4.6	....	50	......	......	97	134	70	91	165	246	172	102	21	117	152	90	104

Meteorological summary, 1873.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.									Mean.													Number of times—		
	A.M.	After-noon.	Night.	Monthly.	Highest.	Date.	Lowest.	Date.	Range.	A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.	Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Max. below 32°.	Max. above 32°.	Min. below 32°.
Jan	.110	.083	.107	.100	.60	28	8.41	2	1.19	17.2	23.3	20.8	20.4	29.1	10.1	19.0	19.6	51	15	—16	26	67	18	0	30
Feb	.110	.131	.154	.132	.62	1	8.58	26	1.04	20.2	27.1	25.0	24.1	36.2	11.1	25.1	23.6	53	19	—18	23	76	7	0	28
Mar	.130	.128	.137	.132	.77	3	8.61	28	1.16	30.6	38.0	34.3	34.3	42.3	22.5	19.8	32.4	60	14	—12	4	72	5	0	24
Apr	.045	*.985	.032	.021	.35	30	8.69	8	.66	40.3	45.3	43.3	43.0	51.5	33.9	17.6	42.7	83	5	25	23	58	0	0	11
May	.080	.072	.064	.072	.53	31	8.65	2	.88	51.9	57.2	52.3	53.8	61.9	42.3	19.6	52.1	87	26	35	30	52	0	0	0
June	.148	.098	.106	.117	.48	1	8.71	30	.77	68.5	73.8	68.7	70.3	79.4	57.2	22.2	68.3	92	23	44	1	48	0	2	0
July	.162	.144	.160	.155	.34	10	8.93	25	.41	69.1	73.9	69.5	70.8	77.2	60.3	16.9	68.8	93	16	50	19	43	0	1	0
Aug	.179	.139	.148	.155	.43	5	8.89	31	.54	68.8	75.9	71.5	72.1	78.5	63.5	15.0	71.0	92	24	53	3	39	0	2	0
Sept	.140	.084	.122	.115	.50	8	8.77	28	.73	57.2	68.2	60.9	62.1	70.8	54.3	16.5	62.6	88	11	41	19	47	0	0	0
Oct	.143	.101	.118	.121	.52	25	8.64	21	.88	44.7	54.5	47.5	48.9	57.5	41.7	15.8	49.6	75	9	23	31	52	1	0	5
Nov	.084	.052	.045	.060	.66	29	8.41	17	1.25	30.7	37.9	34.4	34.3	40.3	28.2	12.1	34.2	59	4	8	28	51	6	0	18
Dec	.185	.171	.184	.180	.62	26	8.42	3	1.20	29.8	34.2	31.9	32.0	38.0	26.1	11.9	32.0	60	3	13	5	47	8	0	19
Year	.126	.099	.115	.113	.77	....	8.41	....	1.36	44.1	50.8	46.7	47.2	55.2	37.6	17.6	46.4	93	....	—18	....	111	45	5	135

Month.	Rainfall			Rel. humidity.				Cloudiness (0-10).				Wind.													Number of days—			
													Maximum.			Number of times blowing from—												
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.	Clear.	Fair.	Cloudy.	.01 rain-fall.
Jan	2.56	.81	2	85	77	78	80	6.8	8.5	7.2	7.5	10,529	48	....	......	4	13	4	4	18	24	14	10	2	3	9	19	13
Feb	0.47	.25	26	79	72	73	74	4.2	6.2	5.0	5.2	7,980	38	....	......	4	11	4	7	12	20	20	4	2	9	11	8	4
Mar	0.89	.26	30	65	58	62	62	5.2	5.5	6.0	5.6	10,938	32	....	......	3	9	4	9	17	9	25	13	4	7	15	9	13
Apr	6.22	1.66	5	72	63	74	70	6.5	8.0	7.5	7.3	7,706	32	....	......	20	15	8	2	4	15	6	6	14	5	8	17	17
May	7.20	2.82	1	70	58	70	66	6.2	6.5	5.8	6.2	8,555	36	....	......	21	18	9	5	11	15	4	1	9	6	14	11	16
June	1.44	.57	26	68	59	70	66	5.2	5.0	3.2	4.5	5,423	30	....	......	14	18	11	7	13	20	4	3	0	6	17	7	6
July	4.05	1.65	3	70	63	72	68	5.0	6.0	3.0	4.8	5,908	20	....	......	14	13	9	12	8	26	5	6	0	10	15	6	15
Aug	1.58	.58	1	72	60	74	69	4.2	4.8	3.0	4.0	4,455	18	....	......	14	22	5	10	5	20	2	5	10	11	14	6	10
Sept	3.53	1.94	28	73	51	66	64	5.2	5.5	4.0	4.9	6,720	35	....	......	11	5	3	10	7	29	8	16	1	9	13	8	8
Oct	2.43	1.73	3	73	56	71	67	6.0	6.2	4.5	5.6	6,520	35	....	......	8	6	5	5	13	31	9	15	1	8	13	10	12
Nov	1.61	.54	23	78	68	75	74	6.5	6.8	5.8	6.4	5,520	32	....	......	5	9	3	10	8	23	14	18	0	4	9	17	11
Dec	4.44	1.24	2	83	79	83	82	6.8	6.2	5.2	6.1	6,799	38	....	......	6	4	3	8	18	25	16	13	0	8	9	14	10
Year	36.42	2.82	....	74	64	72	70	5.6	6.3	5.0	5.7	87,053	48	....	... ..	124	143	68	89	134	257	127	110	43	86	147	132	135

Month.	A.M.	After-noon.	Night.	I										
Jan	.19	.20	.20	.20	.61	1								
Feb	.13	.11	.13	.12	.66	7								
Mar	.19	.16	.17	.17	.65	20	8.5	3						
Apr	.10	.07	.09	.09	.56	4	8.45	8	1					
May	.11	.06	.11	.09	.47	31	8.60	18	.57					
June ...	.10	.06	.07	.08	.41	21	8.65	7	.76	6				
July ...	.13	.09	.11	.11	.28	19	8.74	15	.54	70.5				
Aug	.19	.16	.18	.18	.29	31	8.89	24	.40	68.6	77			
Sept ...	.07	.03	.04	.05	.34	1	8.43	28	.91	59.0	70.3	...		
Oct	.23	.17	.21	.20	.57	24	8.60	15	.97	44.8	56.2	49.3		
Nov	.17	.14	.16	.16	.50	17	8.76	7	.74	27.8	35.6	31.2		
Dec	.31	.28	.29	.29	.68	24	8.57	1	1.11	14.4	22.6	19.9	19.0	....
Year ...	.16	.14	.14	.15	.68	....	8.43	....	1.25	42.9	51.2	45.3	46.5	....

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.																
													Maximum.			Number of times												
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.					o. ra fall.
Jan	.68	.29	19	86	76	84	82	5.5	6.0	6.2	5.9	8,123	27	nw.	13	6	4	1	3	11	33	25	10	0	4	[illegible]	.0	7
Feb	.84	.42	5	81	72	78	77	5.8	4.5	4.5	4.9	6,410	37	w.	13	10	21	4	8	17	10	12	4	1	9	10	10	6
Mar	3.79	1.88	30	80	72	78	77	6.2	5.5	3.8	5.2	7,616	34	sw.	18	8	14	3	5	9	16	14	24	0	8	13	10	9
Apr	3.03	.63	21	72	56	71	66	5.0	5.0	4.0	4.7	8,466	46	ne.	15	11	13	11	8	11	24	9	2	1	7	11	5	11
May	3.24	.96	29	74	59	74	69	5.5	4.8	4.2	4.8	6,926	25	sw.	26	13	12	9	13	13	10	18	5	0	9	14	8	9
June	3.45	1.21	6	72	53	76	67	5.5	4.5	3.5	4.5	6,266	....	....	......	6	8	13	6	19	19	9	6	4	9	16	5	9
July	3.09	.53	16	77	65	80	74	3.2	5.0	3.1	3.8	6,223	....	....	......	9	20	6	9	7	23	6	10	3	17	10	4	7
Aug	2.59	.89	28	79	62	81	74	4.5	4.2	3.0	3.9	6,776	....	....	......	11	20	4	4	13	26	4	10	1	13	10	8	11
Sept	6.43	2.70	28	75	56	75	69	4.2	4.5	3.2	4.0	8,832	50	....	24	7	9	6	11	18	21	12	4	2	10	17	3	12
Oct	.65	.38	6	72	53	68	64	3.2	3.0	2.5	2.9	7,439	31	....	30	13	10	8	5	16	13	15	10	3	18	10	3	3
Nov	1.06	.77	4	75	63	71	70	4.8	6.0	5.5	5.4	9,057	31	....	13	0	0	2	15	16	28	27	2	0	8	10	12	11
Dec	.22	.07	1	73	66	68	69	5.8	6.0	5.5	5.8	8,325	32	....	14	3	3	3	4	15	23	21	15	6	5	14	12	9
Year..........	29.07	2.70	....	76	63	75	71	4.9	4.9	4.1	4.6	....	50	....	......	97	134	70	91	165	246	172	102	21	117	152	90	104

Meteorological summary, 1875.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.																
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan....	.32	.30	.30	.31	.68	17	8.80	29	.88	13.9	22.5	17.4	17.9	26.7	5.5	21.2	16.1	44	23	—20	9	64	20	0	30
Feb....	.21	.18	.19	.16	.73	6	8.61	3	1.12	8.7	20.0	15.5	14.7	24.4	4.9	19.5	14.6	45	3	—13	12	58	20	0	28
Mar....	.10	.09	.12	.10	.54	22	8.33	15	1.21	28.2	35.4	31.8	31.8	37.0	25.0	12.0	31.0	73	30	9	17	64	12	0	21
Apr....	.11	.08	.11	.10	.45	22	8.60	15	.85	39.4	45.3	42.9	42.5	51.6	34.9	16.7	43.2	72	6	17	17	55	2	0	8
May....	.08	.04	.07	.06	.64	16	8.56	7	1.08	53.9	58.2	54.4	55.5	62.2	46.8	15.4	54.5	79	8	27	2	52	0	0	1
June...	.12	.08	.11	.10	.40	13	8.74	1	.66	62.0	65.4	61.9	63.1	70.3	55.6	14.7	62.9	87	11	40	22	47	0	0	0
July ...	.13	.11	.11	.12	.51	7	8.83	15	.68	68.0	70.9	67.4	68.8	75.5	62.0	13.5	68.8	88	15	56	6	32	0	0	0
Aug....	.12	.09	.10	.10	.46	22	8.74	10	.70	65.3	72.5	67.3	68.4	75.0	60.8	14.2	67.9	86	31	52	6	34	0	0	0
Sept....	.19	.15	.16	.17	.46	13	8.72	19	.74	57.8	65.4	59.9	61.0	67.9	53.9	14.0	60.9	87	1	40	21	47	0	0	0
Oct.....	.11	.09	.10	.10	.55	12	8.46	29	1.09	43.5	51.8	47.3	47.5	55.4	40.8	14.6	48.1	73	22	30	31	43	0	0	1
Nov....	.19	.16	.17	.17	.68	21	8.67	18	1.01	34.1	39.9	36.9	37.0	43.1	30.0	13.1	36.5	57	11	0	29	57	1	0	13
Dec	.02	.02	.04	.03	.44	27	8.42	24	1.02	34.8	39.7	35.9	36.8	42.5	29.5	13.0	36.0	68	31	— 1	17	69	3	0	18
Year...	.142	.116	.132	.126	.73		8.33		1.40	42.5	48.9	44.9	45.4	52.6	37.5	15.2	45.0	89		—20		109	58	0	120

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.														Number of days.			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—										Clear.	Fair.	Cloudy.	or rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.					
Jan..........	.95	.58	18	71	72	70	71	6.2	4.5	3.8	4.8	5,873	25	nw.	8	8	15	29	17	8	9	1	2	4	7	16	8	13
Feb..........	1.99	.85	23	72	72	74	72	5.0	6.0	4.0	5.0	6,590	40	w.	3	6	10	13	35	7	7	4	2	0	9	10	9	9
Mar..........	1.43	.30	1	76	74	72	74	6.2	6.0	5.0	5.8	7,926	38	sw.	15	14	7	8	14	12	9	13	13	3	11	6	14	15
Apr..........	2.32	1.02	12	69	61	66	66	5.8	6.0	3.0	5.0	7,042	30	n.	29	22	8	6	20	6	4	10	13	1	8	13	9	11
May..........	3.64	1.10	28	66	64	70	67	3.8	5.2	1.5	3.5	6,310	30	sw.	8	17	7	4	19	9	18	13	3	3	14	10	7	14
June..........	5.17	1.70	21	73	67	78	73	6.8	5.8	5.0	5.8	6,034	25	nw.	23	22	5	3	14	9	9	11	16	1	6	13	11	15
July..........	7.18	2.29	27	79	73	81	78	4.8	5.2	4.0	4.8	5,072	30	ne.	15	19	2	6	11	7	9	15	21	3	10	13	8	15
Aug..........	3.29	1.22	15	75	62	76	71	4.0	4.5	2.5	3.8	6,234	45	s.	5	9	5	11	19	21	8	9	11	0	12	16	3	10
Sept..........	4.39	3.52	9	77	62	76	72	6.0	5.0	3.5	4.8	5,739	35	n.	9	18	8	2	28	14	6	7	3	4	8	13	9	8
Oct..........	4.36	1.49	6	70	62	70	67	6.2	6.8	5.2	6.0	7,669	32	sw.	25	11	19	9	25	16	5	3	4	1	8	9	14	13
Nov..........	.74	.35	26	71	63	69	67	6.5	6.5	6.0	6.2	6,585	25	ne.	13	8	13	10	13	13	16	6	11	0	5	13	12	10
Dec..........	2.62	.66	24	76	72	78	75	6.5	5.8	5.8	6.0	7,014	26	w.	12	9	13	16	17	13	17	3	4	1	5	11	15	13
Year..........	38.08	3.52		73	67	73	71	5.6	5.6	4.1	5.1	78,088	45	s.	......	163	112	117	232	135	117	95	103	21	103	143	119	146

Meteorological summary, 1876.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A. M.	After-noon.	Night.	Monthly.						A. M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan	.19	.13	.15	.16	.67	29	8.50	18	1.17	29.5	37.4	32.2	33.0	41.8	23.8	18.0	32.8	65	1	4	10	61	6	0	23
Feb	.16	.13	.16	.15	.78	1	8.59	27	1.19	28.6	35.7	31.1	31.8	39.8	24.0	15.8	31.9	63	10	— 3	2	66	7	0	17
Mar	.11	.09	.11	.10	.63	26	8.27	16	1.36	31.2	36.3	34.3	33.9	39.8	28.2	11.6	34.0	69	10	10	18	59	8	0	20
Apr	.11	.08	.09	.09	.47	1	8.53	13	.94	43.3	49.7	46.5	46.5	54.0	40.9	13.1	47.4	70	27	32	2	38	0	0	0
May....	.13	.09	.09	.10	.47	23	8.76	9	.71	56.6	62.8	57.6	59.0	68.0	50.7	17.3	59.4	87	29	35	1	52	0	0	0
June ...	.02	.01	.02	.02	.21	28	8.58	17	.63	65.8	70.9	65.9	67.5	75.0	61.1	13.9	68.0	88	11	47	18	41	0	0	0
July ...	.13	.11	.12	.12	.31	21	8.74	5	.57	71.3	77.1	72.1	73.5	80.8	67.7	13.1	74.2	93	8	57	24	36	0	4	0
Aug....	.18	.14	.15	.16	.34	27	8.86	18	.48	70.6	77.1	72.7	73.5	80.3	67.6	12.7	73.9	92	23	54	27	38	0	1	0
Sept ...	.13	.11	.13	.12	.33	16	8.91	20	.42	58.6	64.4	60.4	61.1	67.0	56.5	10.5	61.7	78	1	37	30	41	0	0	0
Oct.....	.09	.03	.05	.06	.53	15	8.51	20	1.02	44.4	53.7	48.7	48.8	57.1	41.6	15.5	49.4	73	30	28	15	45	0	0	0
Nov	.10	.08	.11	.10	.35	30	8.56	2	.79	37.6	41.8	38.5	39.3	45.8	33.2	12.6	39.5	66	12	14	28	52	2	0	11
Dec	.20	.17	.18	.18	.68	16	8.67	12	1.01	17.1	23.0	19.9	20.0	26.9	11.9	15.0	19.4	45	13	—14	9	59	22	0	30
Year ...	.129	.098	.113	.113	.78	....	8.27	....	1.51	46.2	52.5	48.3	49.0	56.4	42.3	14.1	49.4	93	....	—14	....	107	45	5	101

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	Of rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan..........	3.22	1.53	18	77	68	74	73	6.0	5.8	5.5	5.8	6,732	40	n.	1	3	3	2	6	20	29	15	13	2	10	7	14	11
Feb	3.90	1.94	9	70	62	71	68	4.8	4.8	4.2	4.5	5,860	22	s.	5	2	7	4	9	21	13	21	10	0	13	9	7	9
Mar	4.04	1.67	16	76	70	78	74	6.2	7.5	6.0	6.5	6,736	35	ne.	28	15	7	14	6	12	11	15	13	0	5	9	17	16
Apr..........	2.07	1.51	13	64	54	67	62	4.5	5.8	3.8	4.8	6,389	30	w.	5	9	13	10	12	11	19	7	9	0	11	10	9	8
May..........	1.85	.79	6	66	57	80	67	3.5	5.2	4.0	4.2	6,297	45	sw.	6	15	11	8	13	12	21	8	3	2	10	15	6	14
June	5.96	1.87	16	73	66	74	71	6.2	6.0	6.2	6.2	5,494	36	ne.	23	9	7	2	10	17	29	10	4	2	4	11	15	17
July	3.11	1.91	10	75	64	78	72	4.8	4.0	2.2	3.8	5,023	24	nw.	5	19	17	6	8	9	20	4	6	4	12	15	4	10
Aug..........	3.66	1.82	30	75	64	82	73	3.8	4.0	2.0	3.2	4,154	20	....	......	11	13	11	14	20	9	5	4	6	14	14	3	7
Sept..........	3.74	1.72	13	79	69	80	76	6.2	5.5	4.0	5.2	4,885	20	w.	28	20	12	10	5	9	7	5	16	6	9	8	13	11
Oct	1.20	.44	13	67	54	66	63	4.5	5.0	5.0	4.8	6,272	28	sw.	10	6	3	4	8	22	25	13	11	1	13	9	9	9
Nov	3.25	.93	2	75	67	72	72	8.0	8.5	7.5	8.0	5,340	25	sw.	6	8	3	3	6	22	18	10	18	2	2	6	22	12
Dec..........	.48	.13	17	71	65	75	70	6.0	5.0	5.8	5.5	5,903	34	w.	16	3	3	2	6	15	24	14	20	6	5	13	13	13
Year.........	36.48	1.94	....	72	63	75	70	5.4	5.6	4.7	5.2	69,085	45	sw.	......	120	99	76	103	190	225	127	127	31	108	126	132	137

Month																												
Jan.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Feb.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mar.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Apr.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aug.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sept.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oct.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nov.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dec.	2.75	[illegible]	[illegible]	70	74	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year	41.01	2.05	...	77	69	77	74	5.4	5.3	4.1	4.9	[illegible]	[illegible]	[illegible]	....	141	[illegible]	97	114	115	114	85	140	[illegible]	114	111	110	110

Meteorological summary, 1878.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan	.15	.13	.15	.15	.64	7	8.79	10	.85	29.0	34.2	30.6	31.2	37.3	26.2	11.1	31.8	49	19	— 1	7	50	4	0	18
Feb	.05	.04	.05	.05	.55	26	8.46	21	1.09	33.1	38.6	35.5	35.7	41.6	31.3	10.3	36.4	55	28	17	4	38	1	0	11
Mar	.06	.02	.03	.04	.39	20	8.44	2	.95	41.3	47.7	44.0	44.3	51.8	38.7	13.1	45.3	68	23	25	25	43	0	0	2
Apr	.92*	.89*	.91*	.91*	.23	17	8.46	9	.77	49.0	56.2	51.5	52.2	59.3	45.6	13.7	52.5	75	30	36	1	39	0	0	0
May	.19	.04	.05	.09	.35	22	8.67	2	.68	53.7	58.4	54.6	55.5	61.6	48.9	12.7	55.2	78	24	38	13	40	0	0	0
June	.08	.05	.06	.06	.32	5	8.75	2	.57	63.7	68.9	63.6	65.4	71.5	59.1	12.4	65.3	85	30	50	10	35	0	0	0
July	.13	.10	.11	.11	.29	23	8.62	26	.67	72.5	78.1	73.9	74.8	81.6	69.0	12.6	75.3	97	16	59	2	38	0	2	0
Aug	.05	.03	.04	.04	.21	30	8.88	8	.33	70.3	77.8	72.9	73.6	80.4	67.8	12.6	74.1	91	8	57	26	34	0	1	0
Sept	.20	.15	.18	.18	.60	27	8.73	20	.87	60.8	71.5	65.4	65.9	74.7	57.8	16.9	66.2	87	8	43	21	44	0	0	0
Oct	.14	.09	.12	.12	.44	27	8.58	16	.86	48.1	57.1	50.8	52.0	60.1	45.5	14.6	52.8	79	1	27	28	52	0	0	3
Nov	.15	.13	.16	.15	.53	3	8.71	27	.82	39.6	47.0	42.6	43.1	49.9	38.1	11.8	44.0	57	1	31	1	26	0	0	1
Dec	.16	.15	.17	.16	.64	12	8.55	3	1.09	21.3	26.7	23.0	23.7	29.3	18.4	10.9	23.9	46	3	— 9	24	55	15	0	25
Year ...	.182	.143	.161	.163	.64	....	8.44	....	1.20	48.5	55.2	50.7	51.5	58.3	45.5	12.7	51.9	97	....	— 9	....	106	20	3	60

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.														Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—										Clear.	Fair.	Cloudy.	or rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.					
Jan	1.31	.72	31	77	74	80	77	6.0	7.2	5.8	6.2	7,008	23	ne.	31	10	14	4	5	24	11	13	12	0	5	12	14	15
Feb..........	2.12	.74	21	80	71	79	77	6.8	6.2	6.2	6.5	6,202	28	ne.	9	10	27	5	7	14	12	1	6	2	5	10	13	15
Mar	4.39	1.19	28	76	68	76	74	7.2	6.8	4.5	6.2	7,182	35	s.	5	9	16	10	15	12	15	5	11	0	5	16	10	16
Apr..........	5.57	1.53	24	75	61	74	70	6.2	7.2	4.5	6.0	6,414	36	s.	10	12	22	9	7	12	12	13	3	0	7	11	12	13
May	5.22	1.16	29	70	61	75	69	5.0	5.2	4.0	4.8	5,093	25	e.	29	3	13	19	11	10	14	16	6	1	9	12	10	14
June..........	3.02	.87	29	66	62	76	68	5.0	5.8	4.0	5.0	4,607	25	s.	2	6	16	14	16	8	18	9	3	0	8	15	7	12
July	6.09	4.14	25	75	63	76	72	5.8	5.0	4.5	5.0	4,541	25	e.	26	0	36	17	17	3	14	2	3	1	7	15	9	10
Aug..........	3.66	1.36	18	76	61	76	71	4.8	3.8	3.0	3.8	4,599	22	sw.	8	4	21	11	13	9	25	5	5	0	12	16	3	15
Sept	1.99	1.15	25	76	58	72	68	5.5	4.5	3.2	4.5	5,220	28	sw.	25	3	9	2	11	11	32	8	14	0	11	13	6	10
Oct	5.17	1.41	16	74	63	75	71	5.8	6.0	4.5	5.5	6,670	27	sw.	16	7	5	2	3	14	38	11	13	0	7	14	10	13
Nov	.83	.21	16	78	69	78	75	5.8	5.5	4.2	5.2	4,847	26	sw.	2	14	7	10	6	6	21	11	13	2	8	15	7	10
Dec..........	2.58	.69	21	77	68	83	76	6.2	6.5	5.2	6.0	5,284	27	w.	3	3	3	4	4	4	30	20	23	2	9	9	13	19
Year..........	41.95	4.14	....	75	65	77	72	5.8	5.8	4.5	5.4	67,667	36	s.	......	81	189	107	115	127	242	114	112	8	93	158	114	162

Meteorological summary, 1877.

(corrected for temp. and inst. error.)

Temperature.

Number of days—

Year .... 30·71 | 3·25 | .... | 74 | 89

Meteorological summary, 1880.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan....	.117	.102	.119	.113	.57	....	8.48	....	1.09	38.2	42.8	39.3	40.1	47.5	32.1	15.4	39.8	61	11	19	31	42	0	0	12
Feb....	.142	.110	.146	.123	.83	....	8.59	....	1.24	30.4	38.8	34.6	34.6	42.5	27.1	15.4	34.8	63	26	12	5	51	6	0	17
Mar....	.184	.158	.166	.169	.57	....	8.18	....	1.39	33.3	42.2	38.3	37.9	45.3	31.4	13.9	38.4	60	31	19	15	41	1	0	14
Apr....	.035	.033	.055	.041	.46	....	8.41	....	1.05	44.1	52.8	48.5	48.5	53.0	40.3	17.7	49.2	80	18	27	11	53	0	0	3
May....	.127	.099	.091	.106	.52	....	8.61	....	.91	61.0	68.0	63.7	64.2	72.1	57.9	14.2	65.0	85	7	37	1	48	0	0	0
June...	.104	.080	.082	.089	.41	....	8.41	....	1.00	66.5	74.8	68.4	69.9	77.5	63.8	13.7	70.6	91	11	52	15	39	0	1	0
July...	.122	.109	.110	.114	.30	....	8.89	....	.41	69.0	77.2	70.9	72.4	79.7	66.7	13.0	73.2	95	13	57	20	38	0	4	0
Aug....	.160	.134	.148	.147	.37	....	8.85	....	.52	68.8	77.3	71.2	72.4	80.1	65.3	14.8	72.7	93	18	53	4	40	0	1	0
Sept....	.183	.153	.166	.167	.42	....	8.83	....	.59	57.9	67.6	61.9	62.5	70.0	55.3	14.7	62.6	85	5	40	30	45	0	0	0
Oct.....	.179	.150	.165	.165	.52	....	8.55	....	.97	45.6	56.4	50.5	50.8	59.3	43.5	15.8	51.4	78	10	28	18	50	0	0	2
Nov....	.268	.238	.262	.256	.75	....	8.57	....	1.18	27.3	35.8	31.0	31.4	39.0	24.2	14.8	31.6	65	3	1	21	64	10	0	20
Dec....	.179	.175	.181	.178	.75	....	8.47	....	1.28	20.2	25.5	23.2	23.0	30.7	17.4	13.3	24.0	50	5	—15	29	65	11	0	27
Year ...	.150	.128	.141	.140	.83	....	8.18	....	1.65	46.9	54.9	50.1	50.6	58.5	43.8	14.7	51.1	95	....	—15	....	110	28	6	95

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	.01 rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan..........	3.53	.95	4	78	70	71	73	6.2	6.8	4.2	5.8	5,232	29	w.	9	9	2	8	3	15	17	19	8	12	6	16	9	14
Feb	2.91	.70	11	66	61	62	63	5.5	6.5	4.8	5.5	6,053	32	w.	28	4	5	3	8	11	24	18	13	1	7	12	10	12
Mar	2.23	1.08	27	70	54	61	62	6.2	5.8	4.2	5.5	6,823	27	ne.	12	9	8	7	15	12	20	12	10	0	9	15	7	10
Apr	5.20	1.65	24	70	53	66	63	5.0	6.0	5.0	5.2	8,214	36	sw.	15	7	10	8	9	14	22	11	8	1	7	14	9	17
May	4.97	1.26	8	72	57	71	66	4.5	4.5	3.0	4.0	6,141	28	sw.	9	2	13	7	9	24	22	6	7	3	16	8	7	11
June	3.50	1.05	14	76	57	76	69	5.2	5.2	3.5	4.8	5,094	36	sw.	7	7	6	10	6	12	24	11	2	12	8	14	8	13
July	3.07	.84	8	78	65	77	73	3.2	6.2	4.2	4.5	5,028	24	sw.	26	10	12	10	9	9	25	8	7	3	12	18	1	9
Aug	4.47	1.23	24	78	61	77	72	4.8	3.8	4.2	4.2	5,726	24	ne.	2	2	24	10	15	4	23	6	7	2	13	11	7	14
Sept	2.25	.89	18	75	57	72	68	4.8	5.2	3.5	4.5	6,046	23	s.	15	1	15	7	5	17	24	10	9	2	13	9	8	11
Oct	3.09	1.79	3	75	55	68	66	5.0	4.8	4.5	4.8	6,902	30	sw.	16	8	5	7	6	22	22	9	14	0	11	11	9	10
Nov	.87	.45	10	72	60	67	66	4.8	6.0	6.0	5.5	6,614	28	w.	11	4	1	1	4	18	22	30	10	0	12	7	11	9
Dec	1.01	.45	4	73	70	74	72	6.0	7.5	5.8	6.5	6,319	32	w.	5	10	6	4	4	9	14	34	11	1	6	10	15	13
Year	37.10	1.65	....	74	60	70	68	5.1	5.7	4.4	5.1	74,192	36	sw.	......	73	107	82	93	167	259	174	106	37	120	145	101	143

Meteorological summary, 1879.

		rrected for temp. and inst. error).					Temperature.															
Night.	Monthly.	Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
							A. M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
.108	.192	.54	25	8.72	25	.82	16.9	26.1	21.3	21.4	28.3	14.2	14.1	21.2	49	27	—18	3	67	17	0	27
[illegible]	.170	.60	27	8.64	25	.95	24.7	30.4	27.2	27.4	33.6	20.3	13.3	27.0	51	10	— 6	27	57	11	0	26
[illegible]	.165	.68	3	8.78	26	.90	34.9	43.3	39.1	39.1	48.3	32.8	15.5	40.6	71	8	16	15	55	2	0	11
[illegible]	.113	.49	22	8.42	10	1.07	44.0	50.2	46.1	46.8	54.4	40.3	14.1	47.4	80	23	17	3	63	1	0	3
[illegible]	.149	.54	8	8.71	4	.83	55.6	60.7	56.5	57.6	66.0	49.7	16.3	57.8	87	12	39	1	48	0	0	0
[illegible]	[illegible]	.43	18	8.58	15	.90	62.2	68.1	63.7	64.7	71.5	57.1	14.4	64.3	87	24	43	1	44	0	0	0
[illegible]	[illegible]	.33	5	8.83	11	.50	73.0	79.7	75.1	75.9	82.9	68.4	14.5	75.6	93	15	60	5	33	0	3	0
[illegible]	[illegible]	[illegible]	[illegible]	8.86	22	.44	68.6	76.5	72.6	72.6	78.7	65.9	12.8	72.3	91	2	52	17	39	0	1	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.73	55.9	66.7	61.1	61.2	68.5	53.6	14.9	61.0	83	30	39	25	44	0	0	0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	55.3	64.8	58.7	59.9	67.6	54.0	13.6	60.8	84	5	28	31	56	0	0	1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	45.7	42.0	41.9	49.8	35.0	14.8	42.4	69	8	16	20	53	1	0	13
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	30.6	30.3	39.0	23.2	15.8	31.1	62	5	— 2	26	64	7	0	22
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	57.4	42.9	14.5	50.1	93	....	—18	....	111	39	4	103

Wind.	Number of days—			
[illegible] blowing from—	Clear.	Fair.	Cloudy.	[illegible] rain-fall.

Month.	Barometer reading (corrected for temp. and inst. error).								
	Mean.				Highest.	Date.	Lowest.	Date.	Range.
	A.M.	After-noon.	Night.	Monthly.					
Jan	.221	.185	.211	.206	.79	23	8.54	26	1.25
Feb	.134	.096	.120	.117	.62	24	8.44	21	1.18
Mar	.153	.117	.138	.136	.68	7	8.52	26	1.16
Apr	.143	.136	.130	.136	.38	17	8.34	19	1.04
May	.109	.091	.094	.098	.50	2	8.63	10	.87
June ...	.023	.013	.010	.015	.28	20	8.56	18	.72
July ...	.153	.142	.144	.146	.42	22	8.92	7	.50
Aug	.124	.105	.120	.116	.38	20	8.87	8	.51
Sept....	.212	.192	.203	.202	.56	25	8.91	18	.65
Oct.....	.149	.117	.127	.131	.45	19	8.67	30	.78
Nov	.239	.216	.237	.231	.71	2	8.81	23	.90
Dec	.172	.153	.181	.169	.73	7	8.57	20	1.16
Year ...	.153	.131	.143	.142	.79	....	8.34	....	1.45

Month.	[illegible]															
	Mean.															
	A.M.	After-noon.	Night.	Monthly.	Max.	Min.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jan	25.6	31.3	28.1	28.3	35.8	21.5	14.3	28.6	58	26	1	17	57	9	[illegible]	[illegible]
Feb	34.0	42.8	37.8	38.2	46.4	31.6	14.8	39.0	62	12	10	22	52	2	[illegible]	[illegible]
Mar	35.0	41.2	38.7	38.3	46.1	33.2	12.9	39.7	63	29	22	24	41	0	[illegible]	[illegible]
Apr	43.4	48.4	45.8	45.9	53.7	38.4	15.3	46.0	76	6	25	11	50	0	0	[illegible]
May	49.5	55.2	50.5	51.7	58.5	44.4	14.1	51.4	76	8	34	2	41	0	0	0
June ...	61.2	66.7	62.8	63.6	72.0	56.1	15.9	64.0	88	24	42	1	46	0	0	0
July ...	65.6	72.3	67.8	68.6	75.2	62.2	13.0	68.7	90	27	55	5	34	0	0	0
Aug	67.9	75.1	70.5	71.2	76.6	66.2	10.4	71.4	87	22	51	10	36	0	0	0
Sept....	60.7	69.4	65.0	65.0	70.8	59.0	11.8	64.9	87	18	42	22	45	0	0	0
Oct.....	52.5	60.9	56.0	56.5	64.2	51.8	12.4	58.0	77	6	40	29	37	0	0	0
Nov	39.3	44.3	41.5	41.7	48.5	36.6	11.9	42.6	72	11	21	24	51	0	0	10
Dec	23.5	28.6	25.8	26.0	32.9	20.3	12.6	26.6	45	1	— 7	8	52	12	0	26
Year ...	46.5	53.0	49.2	49.6	56.7	43.4	13.3	50.1	90	....	— 7	....	97	23	0	94

Month.	Rainfall.			Rel. humidity.				Cloudiness (o-10).			
	Total.	Greatest in any 24 hours.	Date.	A.M.	Aftern'n.	Night.	Mean.	A.M.	Aftern'n.	Night.	Mean.
Jan	1.55	.49	7	83	84	83	83	4.1	6.7	5.2	5.3
Feb..........	2.24	1.35	28	82	71	78	77	5.1	5.7	3.8	4.9
Mar	3.43	1.43	9	85	74	81	80	6.6	6.4	5.8	6.3
Apr..........	6.72	1.58	22	78	65	74	72	6.4	6.7	5.2	6.1
May	5.52	1.77	26	76	64	74	71	5.8	6.7	5.7	6.1
June	5.71	1.92	2	82	69	81	77	6.4	6.7	4.7	5.9
July..........	3.43	1.00	30	74	59	72	68	3.9	4.8	4.1	4.3
Aug	4.96	1.69	22	85	66	81	77	5.6	5.4	3.6	4.9
Sept	.91	.63	1	79	61	74	71	5.0	4.1	2.3	3.8
Oct	3.40	1.17	8	81	67	81	76	4.5	5.2	4.0	4.6
Nov	1.48	.45	5	80	71	76	76	6.6	7.3	6.0	6.6
Dec..........	1.99	.81	20	77	70	76	75	5.7	6.0	5.0	5.6
Year..........	41.34	1.92	....	80	68	78	75	5.5	6.0	4.6	5.4

Month.	Wind.													Number of days—			
	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	or rain-fall.
		Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan	6,926	30	sw.	26	2	1	7	9	10	22	26	16	0	8	17	6	12
Feb..........	6,625	27	ne.	20	2	5	4	5	13	22	19	14	0	10	8	10	11
Mar	7,778	32	w.	21	5	12	8	11	14	8	17	18	0	5	13	13	14
Apr..........	7,275	28	ne.	9	11	24	14	7	6	9	11	8	0	5	15	10	12
May	7,232	27	ne.	6	21	18	10	11	12	8	8	4	1	6	12	13	14
June	5,916	24	sw.	18	12	19	10	5	3	21	13	6	1	5	16	9	14
July..........	5,573	21	sw.	27	8	17	7	11	9	24	12	5	0	13	9	9	13
Aug	4,997	16	n.	1	9	25	11	6	7	21	7	7	0	9	17	5	16
Sept	5,695	21	ne.	11	2	21	11	14	6	17	11	8	0	13	14	3	6
Oct	5,733	27	sw.	30	2	11	17	10	22	13	10	8	0	11	14	6	12
Nov	6,095	24	ne.	2	5	10	9	12	13	16	18	7	0	3	14	13	14
Dec..........	6,377	28	w.	4	1	0	3	14	10	23	29	13	0	9	10	12	14
Year..........	76,222	32	w.	......	80	163	111	115	125	204	181	114	2	97	159	109	152

Meteorological summary, 1883.

Month.	Ba-ometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan.....	.201	.182	.210	.198	.66	23	8.49	10	1.17	14.6	19.1	15.2	16.3	24.8	8.0	16.8	16.4	40	13	—17	22	57	20	0	31
Feb.....	.343	.310	.316	.323	.78	18	8.67	14	1.11	18.4	27.3	23.2	23.0	30.4	14.7	15.7	22.6	57	16	— 9	1	66	13	0	26
Mar	.138	.120	.135	.131	.62	7	8.57	10	1.05	28.1	34.7	31.5	31.4	39.4	24.8	14.6	32.1	62	14	10	7	52	6	0	26
Apr	.066	.046	.045	.052	.37	2	8.54	10	.83	42.1	48.9	45.9	45.6	54.1	39.5	14.6	46.8	78	14	28	1	50	0	0	2
May	.060	.041	.050	.050	.42	6	8.61	14	.81	50.1	55.3	51.0	52.1	60.5	45.5	15.0	53.0	80	18	36	21	44	0	0	0
June ...	.056	.038	.037	.044	.43	1	8.67	10	.76	61.7	67.6	63.0	64.1	71.2	57.7	13.5	64.4	84	16	48	10	36	0	0	0
July....	.124	.109	.110	.114	.43	18	8.78	12	.65	66.9	76.2	69.9	71.0	78.9	62.4	16.5	70.6	91	3	51	9	40	0	1	0
Aug	.208	.187	.190	.195	.45	6	8.92	19	.53	64.6	72.6	67.6	68.3	74.1	61.7	12.4	67.9	89	19	54	4	35	0	0	0
Sept....	.208	.174	.191	.191	.61	9	8.74	24	.87	56.9	64.7	60.5	60.7	66.7	54.4	12.3	60.6	84	15	42	26	42	0	0	0
Oct......	.218	.200	.219	.212	.70	16	8.56	29	1.14	49.0	54.5	51.8	51.8	57.7	46.7	11.0	52.2	78	8	38	21	40	0	0	0
Nov	.190	.161	.165	.172	.73	16	8.68	9	1.05	37.1	45.7	41.7	41.5	49.9	34.5	15.4	42.2	62	4	10	16	52	2	0	12
Dec.....	.159	.157	.182	.166	.57	22	8.59	17	.98	26.7	33.8	29.9	30.1	38.6	23.4	15.2	31.0	57	7	0	19	57	8	0	22
Year ...	.164	.144	.154	.154	.78	....	8.49	....	1.29	43.0	50.0	45.9	46.3	53.9	39.4	14.4	46.6	91	....	—17	....	108	49	1	119

Month.	Rainfall.			Rel. humidity.				Cloudiness (0–10).				Wind.														Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A.M.	Aftern'n.	Night.	Mean.	A.M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—										Clear.	Fair.	Cloudy.	Of rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.					
Jan..........	1.74	.60	16	74	67	74	72	5.9	6.3	4.5	5.6	7,140	27	sw.	13	0	3	6	11	5	30	25	13	0	9	12	10	16
Feb..........	4.74	1.94	16	73	62	70	68	4.1	5.6	5.3	5.0	5,789	24	sw.	16	1	5	9	3	6	26	25	8	1	7	15	6	12
Mar..........	.42	.18	6	66	52	61	60	5.2	5.7	4.1	5.0	6,704	28	ne.	18	15	18	4	4	5	17	16	14	0	11	12	8	8
Apr	3.72	1.32	5	71	58	64	64	6.0	5.2	3.5	4.9	7,328	33	ne.	22	18	15	11	6	13	16	9	0	2	9	15	6	11
May	7.32	2.39	9	75	61	72	69	7.5	7.3	5.4	6.7	6,705	32	s.	18	19	8	12	13	10	13	9	9	0	4	14	13	17
June	5.61	1.20	12	78	67	77	74	5.4	7.2	3.7	5.4	5,972	25	w.	19	23	5	6	9	10	22	9	6	0	7	14	9	13
July	5.53	1.77	4	76	59	74	70	5.2	4.8	3.2	4.4	5,901	21	sw.	16	14	2	5	10	11	32	11	6	2	13	11	7	11
Aug..........	1.21	1.05	27	74	59	71	68	2.9	4.5	3.0	3.5	4,508	20	w.	20	15	17	9	8	4	24	6	6	4	16	10	5	4
Sept..........	1.36	.68	23	76	60	71	69	3.9	4.8	2.9	3.9	4,783	21	n.	16	17	18	10	10	6	15	5	6	3	14	12	4	8
Oct	7.36	1.94	25	78	66	72	72	7.0	7.4	6.4	6.9	5,925	21	e.	17	14	17	12	11	6	10	7	8	8	6	8	17	19
Nov	5.26	3.39	5	72	61	66	66	4.6	5.0	3.5	4.4	6,440	26	w.	13	4	4	2	6	19	23	18	14	0	14	7	9	9
Dec..........	1.59	0.52	22	74	67	70	70	4.8	6.7	3.7	5.1	5,945	26	nw.	27	7	2	4	4	14	24	17	19	2	9	15	7	11
Year..........	45.86	3.39	....	74	62	70	69	5.2	5.9	4.1	5.1	73,140	33	ne.	......	147	114	90	95	109	252	157	109	22	118	145	101	139

Meteorological summary, 1884.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A. M.	After-noon.	Night.	Monthly.						A. M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan....	.220	.214	.236	.223	.74	26	8.57	13	1.17	16.6	23.0	17.9	19.2	26.5	11.1	15.4	18.8	49	30	—19	5	68	18	0	29
Feb....	.120	.096	.114	.110	.57	15	8.52	19	1.05	24.8	30.5	27.7	27.7	35.4	20.3	15.1	27.8	53	19	— 3	29	56	8	0	25
Mar....	.126	.099	.113	.113	.56	30	8.46	25	1.10	30.5	38.0	34.1	34.2	41.1	27.3	13.8	34.2	59	27	— 1	4	60	9	0	15
Apr....	.059	.043	.054	.052	.48	21	8.38	15	1.10	41.1	47.4	44.4	44.3	50.7	37.9	12.8	44.3	77	30	31	2	46	0	0	1
May....	.065	.053	.055	.058	.49	29	8.61	1	.88	53.4	61.0	55.7	56.7	63.9	48.3	15.6	56.1	78	22	40	2	38	0	0	0
June...	.182	.151	.155	.163	.40	14	8.81	9	.59	62.6	68.6	63.8	65.0	71.1	57.3	13.8	64.2	86	23	47	11	39	0	0	0
July...	.059	.043	.039	.047	.32	20	8.77	5	.55	66.1	73.1	68.4	69.2	75.2	62.0	13.2	68.6	89	22	54	6	35	0	0	0
Aug....	.172	.150	.150	.157	.48	9	8.80	29	.68	64.5	73.3	68.5	68.8	74.9	61.7	13.2	68.3	91	19	51	10	40	0	1	0
Sept....	.159	.125	.134	.139	.54	13	8.64	24	.90	64.2	73.7	68.8	68.9	75.5	62.0	13.5	68.7	89	9	51	21	38	0	0	0
Oct.....	.244	.208	.220	.224	.64	14	8.91	5	.73	51.6	61.5	56.1	56.4	64.2	48.6	15.6	56.4	83	2	28	23	55	0	0	1
Nov....	.176	.166	.180	.174	.56	6	8.50	23	1.06	35.5	44.0	39.3	39.6	48.8	33.1	15.7	41.0	64	9	5	24	59	2	0	9
Dec....	.186	.169	.172	.176	.71	25	8.39	6	1.32	25.4	31.0	28.8	28.4	37.8	22.2	15.6	30.0	61	30	—11	19	72	10	0	20
Year...	.147	.126	.135	.136	.74	....	8.38	....	1.36	44.7	52.1	47.8	48.2	55.4	41.0	14.4	48.2	91	....	—19	....	110	47	1	100

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	or rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan..........	1.39	.39	1	72	67	67	69	6.2	6.1	3.9	5.4	6,713	26	w.	30	6	4	2	3	9	28	31	10	0	9	13	9	13
Feb..........	3.27	1.13	12	72	69	68	70	6.6	8.1	6.5	7.1	5,412	26	w.	19	4	16	5	5	16	7	16	17	1	4	11	14	16
Mar..........	5.16	3.20	25	72	63	68	68	6.6	6.9	6.1	6.5	6,168	28	sw.	11	19	12	10	5	13	7	12	13	2	4	11	16	15
Apr..........	3.05	1.74	15	75	59	69	68	5.9	6.9	4.8	5.9	6,364	36	w.	27	21	11	24	4	4	5	10	11	0	9	9	12	9
May..........	1.53	.68	1	72	57	68	66	4.8	5.6	3.3	4.6	6,016	25	nw.	27	24	7	10	9	16	17	6	11	0	9	17	5	10
June..........	2.11	.62	1	76	66	78	73	6.1	5.5	3.3	5.0	4,496	23	nw.	9	24	11	17	6	5	6	5	9	7	9	13	8	6
July	3.71	1.46	23	76	61	73	70	5.3	6.2	2.5	4.7	4,293	28	ne.	23	13	13	15	4	11	10	13	13	1	5	25	1	12
Aug..........	2.50	1.27	28	78	57	70	68	4.2	4.3	2.1	3.5	4,996	20	sw.	25	7	14	18	5	19	8	10	8	4	15	12	4	9
Sept..........	2.29	1.09	27	77	57	71	69	3.9	3.6	3.6	3.7	5,800	24	w.	17	7	8	14	4	22	21	12	2	0	15	9	6	8
Oct..........	3.59	1.39	7	77	60	71	69	4.4	5.1	3.1	4.2	5,745	35	n.	8	8	3	7	7	15	27	20	6	0	14	11	6	10
Nov..........	1.80	.82	3	82	68	76	75	5.7	4.9	3.9	4.8	5,441	22	nw.	23	9	3	5	5	10	23	17	17	1	9	14	7	9
Dec..........	4.21	.93	28	83	76	80	80	8.1	7.2	6.9	7.4	6,574	29	sw.	31	0	4	2	9	21	19	19	19	0	4	9	18	18
Year..........	34.61	3.20	....	76	63	72	70	5.6	5.9	4.2	5.2	68,018	36	w.	......	142	106	129	66	161	178	171	129	16	106	154	106	135

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	.212	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	6	1.47	[illegible]	22.1	[illegible]	[illegible]	[illegible]	9.6	17.4	[illegible]	[illegible]	9	-16	14	44	12	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	47	3	-14	11	[illegible]	12	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	23.7	15.2	[illegible]	[illegible]	[illegible]	4	[illegible]	54	7	[illegible]	[illegible]
Apr	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	.77	[illegible]	[illegible]	[illegible]	45.2	[illegible]	[illegible]	15.2	[illegible]	[illegible]	21	27	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14.5	[illegible]	[illegible]	24	34	7	[illegible]	0	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	7	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	65.4	[illegible]	7	42	[illegible]	46	0	0	0
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	.67	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	15.3	73.1	[illegible]	20	53	1	41	0	3	0
Aug	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	74.3	[illegible]	11.9	[illegible]	[illegible]	12	55	15	30	0	0	0
Sept	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12.3	64.5	81	21	47	6	34	0	0	0
Oct	[illegible]	[illegible]	[illegible]	[illegible]	.42	9	[illegible]	[illegible]	[illegible]	47.1	[illegible]	[illegible]	51.0	[illegible]	45.5	12.1	51.6	69	2	36	30	33	0	0	0
Nov	[illegible]	[illegible]	[illegible]	[illegible]	.50	27	[illegible]	6	[illegible]	[illegible]	44.4	41.9	41.9	[illegible]	[illegible]	12.0	42.7	66	6	28	14	38	0	0	4
Dec	[illegible]	[illegible]	[illegible]	[illegible]	.73	26	2.24	9	1.49	[illegible]	[illegible]	20.7	21.1	[illegible]	24.7	14.2	31.8	50	23	-3	7	53	7	0	20
Year ...	.121	.101	.117	.113	.77	....	8.24	....	1.53	43.2	49.9	46.3	46.5	54.4	39.8	14.6	47.1	94	....	-14	....	108	50	3	108

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.													Number of days—			
													Maximum.			Number of times blowing from—												
	Total.	Greatest in any 24 hours.	Date.	A.M.	Aftern'n.	Night.	Mean.	A.M.	Aftern'n.	Night.	Mean.	Total.	Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.	Clear.	Fair.	Cloudy.	.01 rain-fall.
Jan	3.18	1.24	5	78	67	77	74	4.2	5.7	4.6	4.8	7,316	22	sw.	26	5	5	3	2	16	32	22	8	0	10	13	8	11
Feb.	2.01	.86	8	79	80	80	80	4.5	5.7	5.1	5.1	4,934	24	ne.	8	5	6	4	4	10	28	12	12	3	10	9	9	11
Mar	.57	.20	6	79	72	75	75	5.3	6.3	5.4	5.7	5,493	28	sw.	9	17	11	3	3	9	20	15	8	7	6	17	8	8
Apr	4.00	1.71	17	81	70	78	76	6.2	6.7	5.5	6.1	6,292	24	n.	2	18	12	15	6	14	7	7	9	2	3	19	8	16
May	3.17	1.23	29	76	63	74	71	5.2	5.1	4.4	4.9	5,406	30	sw.	8	23	13	9	10	8	12	9	6	3	11	13	7	11
June	5.20	3.44	2	78	60	75	71	4.8	5.3	3.3	4.5	4,649	24	n.	13	13	5	17	10	9	13	11	7	5	9	15	6	11
July	2.44	.83	9	80	65	77	74	4.3	4.6	2.5	3.8	4,233	26	n.	28	14	12	10	8	13	11	10	5	10	9	20	2	13
Aug	11.28	6.19	2	80	63	76	73	5.7	4.7	3.4	4.6	6,092	27	n.	2	16	13	14	9	9	14	9	9	0	8	18	5	13
Sept	2.97	1.65	8	77	64	75	72	4.7	4.8	4.0	4.5	5,726	25	s.	8	12	5	18	9	12	15	12	6	1	13	8	9	9
Oct	3.87	2.22	19	81	64	75	73	5.4	7.1	4.0	5.5	6,136	24	ne.	19	18	6	7	6	14	12	16	13	1	8	13	10	11
Nov	2.33	1.17	5	80	72	76	76	6.8	7.1	6.1	6.7	6,185	24	sw.	7	7	9	1	8	9	20	21	15	0	4	13	13	12
Dec	3.35	1.29	8	82	79	82	81	4.7	6.7	4.9	5.4	6,700	26	nw.	5	6	4	6	10	10	35	14	8	0	8	15	8	15
Year	44.37	6.19	....	79	68	77	75	5.2	5.8	4.4	5.1	69,162	30	sw.	......	154	101	107	85	133	219	158	106	32	99	173	93	141

Meteorological summary, 1886.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.																
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan....	.141	.115	.125	.127	.62	23	8.45	3	1.17	19.1	23.5	21.6	21.4	30.8	14.0	16.8	22.4	48	1	—14	....	62	17	0	28
Feb....	.131	.138	.175	.148	.71	4	8.46	25	1.25	24.7	31.1	28.5	28.1	38.9	19.9	19.0	29.4	56	9	— 6	....	62	8	0	23
Mar....	.170	.149	.154	.158	.62	2	8.18	20	1.44	32.8	39.2	36.4	36.1	44.2	30.1	14.1	37.2	70	19	15	....	55	3	0	17
Apr....	.155	.149	.162	.155	.55	19	8.44	1	1.11	46.6	52.7	48.0	49.1	57.3	42.1	15.2	49.7	81	23	23	....	58	0	0	5
May....	.089	.083	.071	.081	.44	17	8.72	9	.72	53.7	60.1	57.2	57.0	65.5	48.9	16.6	57.2	82	21	40	....	42	0	0	0
June...	.111	.098	.099	.103	.38	3	8.84	17	.54	63.7	69.3	65.1	66.0	73.7	58.7	15.0	66.2	87	15	49	....	38	0	0	0
July...	.125	.105	.095	.108	.31	1	8.87	13	.44	68.1	75.3	70.8	71.4	78.8	64.9	13.9	71.8	94	6	55	....	39	0	2	0
Aug....	.111	.097	.105	.104	.35	19	8.82	29	.53	68.8	76.3	72.0	72.4	78.7	66.5	12.2	72.6	92	21	53	....	39	0	1	0
Sept....	.184	.152	.165	.167	.44	18	8.84	30	.60	61.5	71.5	65.2	66.1	73.4	58.7	14.7	66.0	86	7	42	....	44	0	0	0
Oct.....	.292	.269	.293	.285	.66	16	8.33	14	1.33	51.7	61.4	56.8	56.6	64.7	49.3	15.4	57.0	79	12	32	....	47	0	0	0
Nov....	.126	.089	.105	.107	.52	15	8.47	23	1.05	34.3	42.2	38.0	38.2	46.2	30.5	15.7	38.4	69	2	16	....	53	3	0	16
Dec....	.247	.221	.257	.242	.72	4	8.61	14	1.11	21.6	28.6	24.8	25.0	33.8	16.8	17.0	25.3	60	11	—10	....	70	13	0	27
Year...	.157	.139	.150	.149	.72	....	8.18	....	1.54	45.6	52.6	48.7	49.0	57.2	41.7	15.5	49.4	94	....	—14	....	108	44	3	116

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	Of rain-fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan..........	3.56	.71	15	84	79	88	84	6.1	7.1	6.1	6.4	7,498	28	w.	16	6	7	8	8	14	19	21	10	0	4	15	12	19
Feb..........	1.51	.53	11	81	69	81	77	6.6	6.2	3.9	5.6	6,895	29	sw.	25	1	4	5	10	17	20	17	10	0	5	16	7	9
Mar..........	1.79	.54	20	84	69	81	78	6.1	5.8	5.2	5.7	6,854	20	nw.	22	15	8	8	4	14	13	12	19	0	7	11	13	9
Apr..........	1.29	.42	29	87	76	86	83	5.7	5.5	3.7	5.0	6,148	30	nw.	6	17	7	7	17	8	13	4	17	0	8	13	9	10
May..........	1.00	.52	9	77	65	74	72	4.3	5.6	2.8	4.2	5,752	22	nw.	6	18	15	11	14	6	15	4	9	1	12	14	5	10
June..........	.94	.58	15	77	66	76	73	3.9	5.1	3.1	4.0	4,932	20	nw.	7	10	27	6	18	7	12	3	7	0	10	18	2	8
July..........	1.53	.61	13	75	62	74	70	3.4	3.2	1.3	2.6	5,472	23	ne.	7	16	24	14	11	8	8	7	5	0	18	11	2	6
Aug..........	3.38	1.39	28	79	64	75	73	5.2	4.7	3.5	4.5	5,432	24	nw.	16	9	17	17	17	12	8	9	4	0	8	19	4	11
Sept..........	6.93	2.11	9	80	59	76	71	4.9	5.4	3.4	4.6	5,543	22	nw.	18	3	5	6	22	19	16	12	7	0	11	11	8	13
Oct..........	1.42	.59	14	76	63	74	71	3.9	4.9	2.6	3.8	5,568	37	sw.	14	6	5	7	18	23	16	6	12	0	19	4	8	7
Nov..........	1.66	.74	16	83	71	76	77	5.2	5.4	5.0	5.2	6,924	32	sw.	18	8	0	9	1	23	18	23	8	0	10	10	10	10
Dec..........	1.76	.37	12	81	73	73	76	5.9	5.8	5.3	5.7	5,111	27	nw.	14	2	1	3	7	28	23	19	10	0	8	12	11	12
Year..........	26.77	2.11	....	80	68	78	75	5.1	5.4	3.8	4.8	72,129	37	sw.	......	111	120	101	147	179	181	137	118	1	120	154	91	124

Month	Rainfall			[illegible]			
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Jan.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Feb.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Mar.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Apr.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
May	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
June	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
July	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aug.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sept.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Oct.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Nov.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Dec.	3·[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year	29·13	1·39	....	77	66	74	74

Meteorological summary, 1888.

Month.	Barometer reading (corrected for temp. and inst. error).									Temperature.															
	Mean.				Highest.	Date.	Lowest.	Date.	Range.	Mean.							Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A.M.	After-noon.	Night.	Monthly.						A.M.	After-noon.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min below 32°.
Jan	.301	.308	.318	.309	96	16	8.66	1	1.30	11.7	18.0	15.6	15.1	23.8	6.0	17.8	14.9	44	6	—17	16	60	23	0	30
Feb	.166	.129	.146	.156	89	15	8.40	25	1.49	19.7	25.6	23.8	23.0	30.9	14.1	16.8	22.5	47	20	—18	9	65	10	0	26
Mar	.209	.194	.219	.214	63	12	8.56	20	1.07	27.7	33.5	30.4	30.5	37.1	22.7	14.4	29.9	64	19	— 1	22	65	11	0	27
Apr	.278	.238	.244	.261	63	12	8.69	1	.94	40.9	50.1	45.1	45.4	55.7	37.1	18.6	46.4	83	28	30	3	53	0	0	6
May	.054	.039	.036	.045	41	20	8.69	27	.72	49.6	55.5	52.7	52.6	61.3	44.9	16.4	53.1	81	27	32	1	49	0	0	0
June ...	.073	.054	.051	.062	38	7	8.80	10	.58	63.6	71.5	67.1	67.4	75.7	58.8	16.9	67.2	90	20	43	2	47	0	0	0
July ...	.187	....	.139	.163	34	20	8.96	12	.38	70.6	....	73.4	72.0	80.6	64.6	16.0	72.6	94	31	56	13	38	0	3	0
Aug	.182	....	.151	.167	42	23	8.89	6	.53	66.7	....	71.6	69.2	76.7	61.9	14.8	69.3	91	3	51	23	40	0	1	0
Sept ...	.213	....	.171	.192	48	29	8.57	30	.91	56.4	....	62.9	59.6	66.7	52.9	13.8	59.8	88	11	36	29	52	0	0	0
Oct	.098	....	.084	.091	40	21	8.56	1	.84	45.5	....	51.2	48.4	55.9	42.3	13.6	49.1	76	31	32	20	45	0	0	1
Nov	.257	....	.230	.244	71	20	8.74	10	.97	38.8	....	43.0	40.9	47.1	36.0	11.1	41.6	75	1	20	17	55	1	0	7
Dec	.178	....	.174	.176	54	14	8.63	26	.91	29.7	....	32.9	31.3	38.0	26.6	11.4	32.3	53	26	15	28	38	6	0	24
Year ...	.183	....	.164	.173	96	....	8.40	....	1.56	......	....	....	....	54.1	39.0	15.1	46.6	94	....	—18	....	112	51	4	121

Month.	Rainfall.			Rel. humidity.				Cloudiness (0-10).				Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Aftern'n.	Night.	Mean.	A. M.	Aftern'n.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	.01 rain. fall.
													Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan	1.56	.51	6	74	72	79	75	5.4	7.1	5.8	6.1	8,294	37	sw.	1	2	5	5	13	1	18	27	21	1	6	5	10	12
Feb	1.51	.76	24	80	72	76	76	4.7	6.5	3.2	4.9	7,702	45	s.	13	4	7	8	12	9	15	20	12	0	11	12	6	9
Mar	2.99	1.01	25	75	70	71	72	7.0	7.3	5.5	6.6	8,931	37	w.	21	6	25	8	8	5	13	17	11	0	7	11	13	12
Apr	2.13	.90	9	66	56	66	62	5.0	5.2	2.3	4.1	9,112	37	sw.	13	11	15	10	13	3	13	14	11	0	12	13	5	10
May	6.22	2.43	27	72	62	77	70	6.1	6.4	5.7	6.0	7,507	44	sw.	4	8	13	20	13	4	16	10	8	1	7	10	14	16
June	1.66	.97	27	71	58	69	66	4.4	6.3	3.4	4.7	7,383	30	sw.	13	7	18	12	11	9	18	11	4	0	8	17	5	8
July	3.93	1.29	31	69	....	67	82	3.5	......	5.7	4.6	6,450	39	ne.	12	7	16	10	6	6	9	6	1	1	11	8	12	11
Aug	2.10	1.00	2	69	....	62	66	4.5	......	4.1	4.3	7,730	40	nw.	2	9	11	8	5	1	18	9	1	0	9	11	11	9
Sept	.98	.45	16	69	....	62	66	3.4	......	2.6	3.0	6,670	27	n.	25	2	14	3	9	2	17	5	4	4	13	9	8	6
Oct	2.95	1.31	18	70	....	67	69	5.2	......	3.1	4.2	8,210	34	sw.	19	4	12	2	6	4	16	8	8	2	9	11	11	11
Nov	2.89	1.10	7	79	....	76	78	5.7	......	4.2	5.0	7,404	38	sw.	5	2	13	2	3	5	14	9	12	0	8	6	16	11
Dec	1.94	.89	25	84	....	79	81	6.5	......	4.6	5.6	8,360	41	s.	26	13	2	0	1	12	17	9	7	1	9	5	17	9
Year	30.86	2.43	....	....	....	....	....	......	......	......	......	93,753	45	s.	......	75	151	88	100	61	184	145	100	10	110	128	128	124

Meteorological summary, 18[illegible].

		[illegible] Monthly		Highest.	Date.	Lowest.	Date.	Range.	Mean A.M.	Mean Night.	Mean Monthly.	Mean Max.	Mean Min.	Range.	Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times— Max. below 32°.	Max. above 90°.	Min. below 32°.
[illegible]	.10	.11	.15	.55	19	8.69	9	1.46	25.8	30.9	28.4	35.0	23.0	12.0	29.0	55	16	zero	21	55	11	0	28
Feb	.23	.22	.21	.69	21	8.42	4	1.47	15.3	21.9	19.1	26.8	13.0	13.8	19.9	48	4	—11	23	59	16	0	27
Mar	.13	.11	.12	.45	22	8.79	6	.67	34.3	39.2	36.8	44.7	32.1	12.6	38.4	68	16	20	9	48	2	0	11
Apr	.15	.11	.13	.62	7	8.76	12	.86	44.0	47.1	45.5	52.9	40.7	12.2	46.8	73	20	29	6	44	0	0	1
May	.09	.05	.07	.31	4	8.78	27	.53	52.4	57.0	54.7	64.5	49.1	15.4	56.8	88	8	36	2	52	0	0	0
June ...	.11	.09	.10	.48	24	8.75	7	.73	59.9	62.5	61.2	69.5	55.1	14.4	62.3	86	19	42	1	44	0	0	0
July ...	.13	.10	.11	.31	16	8.79	27	.52	68.5	71.6	70.0	77.2	63.8	13.4	70.5	90	9	54	15	36	0	0	0
Aug	.23	.19	.21	.39	6	8.92	13	.47	66.4	72.7	69.6	77.8	63.3	14.5	70.5	88	29	54	6	34	0	0	0
Sept....	.17	.13	.15	.49	27	8.75	20	.74	58.2	64.8	61.5	69.9	55.7	14.2	62.8	84	14	35	27	49	0	0	0
Oct.....	.26	.24	.25	.60	23	8.76	25	.84	45.7	51.6	48.7	55.2	43.5	11.7	49.3	79	11	35	8	44	0	0	0
Nov	.18	.18	.18	.69	16	8.61	21	1.08	35.9	39.5	37.7	41.3	34.0	7.3	37.6	57	1	12	30	45	3	0	11
Dec	.17	.16	.16	.63	30	8.47	29	1.16	37.9	41.8	39.9	47.2	34.1	13.1	40.6	64	24	15	30	49	1	0	7
Year ...	.16	.14	.15	.89	......	8.09	......	1.80	45.4	50.0	47.7	55.2	42.3	12.9	48.7	90	....	—11	....	101	33	0	85

Month.	Rainfall.			Rel. humidity.			Cloudiness (0-10).			Wind.														Number of days—			
											Maximum.			Number of times blowing from—													
	Total.	Greatest in any 24 hours.	Date.	A.M.	Night.	Mean.	A.M.	Night.	Mean.	Total.	Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		Clear.	Fair.	Cloudy.	Of rainfall.
Jan	1.64	.68	8	84	81	82	5.2	3.9	4.6	7,807	44	sw.	17	2	3	5	4	1	25	7	12	3		10	8	13	5
Feb	1.31	.44	15	84	81	82	7.5	3.6	5.6	7,394	32	sw.	19	1	4	2	2	4	13	15	14	1		4	13	11	13
Mar	1.43	.93	30	81	71	76	5.0	4.2	4.6	7,985	40	n.	18	12	12	2	7	0	6	12	10	1		9	15	7	5
Apr	2.35	1.03	11	77	74	76	4.2	5.4	4.8	7,936	36	sw.	24	5	15	9	9	2	10	3	7	0		10	9	11	8
May	5.38	1.42	10	72	70	71	4.9	7.3	6.1	9,771	48	n.	31	15	15	1	2	9	10	3	6	1		4	15	12	14
June	2.93	.68	16	82	76	79	4.8	7.8	6.3	5,614	28	nw.	19	8	11	5	6	4	13	8	4	1		1	13	16	12
July	9.56	4.02	27	75	70	72	3.5	4.9	4.5	5,979	36	sw.	27	4	13	10	5	3	16	5	6	0		14	8	9	12
Aug	.39	.16	8	68	63	66	2.7	3.6	3.7	5,290	25	sw.	8	3	10	3	7	8	20	5	5	1		15	11	5	7
Sept	2.75	2.08	4	74	64	69	5.8	3.4	5.4	5,609	28	nw.	17	2	7	4	9	8	13	3	12	2		8	11	11	7
Oct	1.82	.82	12	74	66	70	6.2	4.4	4.9	7,096	32	ne.	25	9	12	5	8	5	8	3	12	0		14	7	10	7
Nov	3.49	1.47	1	86	80	83	7.3	5.8	6.9	7,488	37	w.	28	4	9	5	5	4	16	2	14	1		5	9	16	17
Dec	1.90	.95	9	78	74	76	6.6	5.6	5.9	7,664	36	nw.	29	2	3	3	11	3	24	8	7	1		10	9	12	10
Year	34.95	4.02	....	78	72	75	5.3	5.0	5.3	85,633	48	n.	......	67	114	54	75	51	174	74	109	12		104	128	133	117

Meteorological summary, 1890.

Month.	Barometer reading (corrected for temp. and inst. error).								Temperature.														
	Mean.			Highest.	Date.	Lowest.	Date.	Range.	Mean.						Mean max. and min.	Highest.	Date.	Lowest.	Date.	Absolute range.	Number of times—		
	A. M.	Night.	Monthly.						A. M.	Night.	Monthly.	Max.	Min.	Range.							Max. below 32°.	Max. above 90°.	Min. below 32°.
Jan	.37	.36	.36	.94	3	8.54	12	1.40	28.6	33.3	30.9	38.0	23.7	14.3	30.8	62	12	— 5	22	67	9	0	21
Feb	.17	.15	.16	.57	21	8.70	19	.87	29.2	34.2	31.7	38.7	26.2	12.5	32.4	59	4	3	21	56	6	0	20
Mar	.18	.17	.18	.61	8	8.50	28	1.11	25.3	31.3	28.3	35.7	23.3	12.4	29.5	56	21	zero	1	56	9	0	24
Apr	.23	.19	.21	.62	20	8.60	8	1.02	42.9	45.9	44.4	52.8	38.4	14.4	45.6	75	30	28	14	47	0	0	3
May....	.05	.02	.04	.48	11	8.69	18	.79	50.0	55.1	52.6	61.5	45.2	16.3	53.3	86	30	34	1	52	0	0	0
June...	.13	.08	.10	.48	8	8.85	5	.63	67.9	71.3	69.6	77.6	62.7	14.9	70.1	92	28	52	8	40	0	1	0
July ...	.16	.13	.14	.38	16	8.88	1	.50	69.6	74.1	71.8	78.9	65.3	13.6	72.1	93	7	56	25	37	0	4	0
Aug....	.21	.17	.19	.46	23	8.94	26	.52	64.4	69.0	66.7	73.7	61.4	12.3	67.5	96	2	51	22	45	0	2	0
Sept....	.25	.21	.23	.57	28	8.91	12	.66	57.0	63.0	60.0	66.8	54.0	12.8	60.4	88	6	39	13	49	0	0	0
Oct	.07	.06	.06	.32	21	8.58	28	.74	49.2	52.1	50.7	56.6	46.1	10.5	51.3	73	9	28	31	45	0	0	2
Nov	.17	.17	.17	.52	22	8.83	1	.69	37.8	43.8	41.3	48.7	35.1	13.6	41.9	67	5	27	3	40	0	0	7
Dec	.21	.19	.20	.55	25	8.72	10	.83	27.7	31.7	29.7	36.6	24.5	12.1	30.5	53	30	8	4	45	10	0	25
Year ...	.18	.16	.17	.94	......	8.50	......	1.44	45.8	50.4	48.1	55.5	42.2	13.3	48.8	96	....	— 5	....	101	34	7	102

Month.	Rainfall.			Rel. humidity.			Cloudiness (0–10).			Wind.													Number of days—			
	Total.	Greatest in any 24 hours.	Date.	A. M.	Night.	Mean.	A. M.	Night.	Mean.	Total.	Maximum.			Number of times blowing from—									Clear.	Fair.	Cloudy.	.01 rainfall.
											Velocity.	Direction.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.				
Jan	2.98	.94	3	84	78	81	6.7	5.5	5.9	7,978	42	nw.	8	5	2	1	7	6	19	10	12	0	7	13	11	14
Feb..........	2.42	.53	7	85	78	82	6.8	5.5	6.5	12,105	48	w.	5	1	12	3	7	3	13	7	10	0	7	6	15	12
Mar	2.10	.60	11	79	70	74	5.5	4.8	5.1	13,806	68	ne.	27	5	11	5	8	3	8	7	15	0	9	13	9	15
Apr..........	3.23	.90	13	74	70	72	4.7	4.9	4.6	14,912	56	sw.	12	4	26	7	6	7	5	2	3	0	13	9	8	12
May..........	5.13	2.60	9	78	64	71	5.7	6.2	6.1	13,538	59	ne.	10	1	15	3	8	5	15	7	8	0	8	10	13	16
June..........	3.25	1.03	10	76	70	73	5.6	5.6	5.1	9,225	53	sw.	5	3	13	5	11	6	11	9	2	0	8	17	5	14
July	2.57	1.31	14	66	61	64	3.8	3.9	3.5	11,503	52	ne.	4	3	13	4	13	6	14	4	4	1	13	17	1	5
Aug..........	2.58	1.47	20	76	71	74	5.5	4.8	4.7	10,297	45	s.	8	4	16	7	10	6	11	4	4	0	12	10	9	10
Sept..........	1.39	.98	7	79	72	76	6.0	4.6	5.1	12,436	49	nw.	19	6	13	6	10	7	10	3	5	0	9	12	9	7
Oct	4.20	1.16	25	86	77	82	6.7	5.7	7.0	10,751	50	sw.	13	8	7	4	9	6	10	2	15	1	4	9	18	15
Nov	1.59	.84	16	80	66	73	4.8	6.5	5.3	12,224	45	sw.	5	3	5	4	4	3	16	13	12	0	11	7	12	8
Dec..........	1.25	.47	31	80	73	76	7.0	4.1	5.3	13,582	54	sw.	13	10	4	2	8	5	12	10	10	1	10	10	11	8
Year..........	32.69	2.60	....	79	71	75	5.7	5.2	5.4	142,357	68	ne.	......	53	137	51	101	63	144	78	100	3	111	133	121	136

Meteorological summary, [illegible].

	[illegible] corrected for temp. and inst. error.								Temperature.													Number of times—		
	[illegible]								Mean.															
	[illegible]	Night.	Monthly.	Highest.	Date.	Lowest.	Date.	Range.	A.M.	Night.	Monthly	Max.	Min.	Range.	Mean max. and min.	Highest.	Date.	Lowest.	Date.	Annual range.		Max. below 32°.	Max. above 90°.	Min. below 32°.
[illegible]an	.16	.16	.16	.75	8	8.29	1	1.46	28.3	30.5	29.4	35.0	25.4	9.6	30.2	54	1	10	13	44		9	0	25
Feb	.12	.10	.11	.60	14	8.34	24	1.26	24.7	30.7	27.7	35.7	21.5	14.2	28.6	58	14	−8	4	66		9	0	23
Mar	.15	.12	.14	.69	1	8.63	31	.96	27.5	32.2	29.8	34.2	23.1	11.1	[illegible]	57	17	7	4	50		10	0	24
Apr	.14	.11	.12	.46	28	8.86	2	.54	44.5	47.9	46.2	53.9	40.0	13.9	47.0	75	26	23	4	52		0	0	5
May	.26	.20	.23	.55	5	8.69	31	.59	51.2	54.7	53.0	61.1	45.7	15.4	53.4	81	9	36	4	45		0	0	0
June	.09	.05	.07	.37	5	8.70	18	.67	63.2	66.1	64.6	74.2	[illegible]	[illegible]	[illegible]	88	15	44	4	44		0	0	0
July	.18	.14	.16	.41	9	8.94	29	.48	64.9	68.7	66.8	73.4	60.5	[illegible]	67.0	87	14	55	5	32		0	0	0
Aug	.14	.11	.12	.30	28	8.77	20	.53	66.2	70.5	68.4	75.5	62.5	13.0	69.0	96	9	49	28	47		0	3	0
Sept	.27	.22	.25	.49	9	9.00	28	.49	64.4	70.7	67.6	76.0	62.1	13.9	69.0	91	24	48	29	43		0	1	0
Oct	.23	.22	.22	.58	27	8.94	14	.64	47.7	54.5	51.1	60.0	45.1	14.9	[illegible]	80	8	[illegible]	22	[illegible]		0	0	0
Nov	.17	.17	.17	.72	18	8.60	10	1.12	31.1	35.4	33.2	39.4	28.2	11.2	33.8	60	7	3	29	57		7	0	17
Dec	.16	.13	.14	.74	11	8.49	3	1.25	32.3	37.0	34.6	41.6	29.1	12.5	35.4	57	14	9	26	48		4	0	16
Year	.17	.14	.16	.75	......	8.29	......	1.46	45.5	49.9	47.7	55.0	42.0	13.0	48.5	96	....	− 8	....	104		41	4	110

Month.	Rainfall.			Rel. humidity.			Cloudiness (0-10).			Wind.														Number of days—			
											Maximum.			Number of times blowing from—													
	Total.	Greatest in any 24 hours.	Date.	A. M.	Night.	Mean.	A. M.	Night.	Mean.	Total.	Veloc-ity.	Direc-tion.	Date.	N.	NE.	E.	SE.	S.	SW.	W.	NW.	Calm.		Clear.	Fair.	Cloudy.	Of rain-fall.
Jan	1.99	1.25	1	85	79	82	7.2	6.4	7.1	11,142	54	ne.	2	4	7	4	7	6	13	9	12	0		3	9	19	11
Feb	1.95	.99	19	82	79	81	5.6	5.5	5.5	13,357	60	sw.	24	5	3	4	7	4	13	13	7	0		10	8	10	12
Mar	2.13	.58	30	84	84	84	7.8	7.2	7.7	14,319	56	sw.	15	3	19	8	11	0	9	8	4	0		2	12	17	15
Apr	3.14	1.48	9	80	70	75	5.4	5.6	5.2	12,043	50	se.	20	11	12	3	9	4	8	8	5	0		10	10	10	15
May	2.09	.84	22	71	62	67	4.5	5.1	4.1	11,865	51	s.	9	9	23	1	11	3	11	3	0	1		14	10	7	7
June	2.42	.79	28	82	80	81	4.5	5.3	5.6	9,961	45	e.	6	3	21	7	11	7	3	2	5	1		7	12	11	11
July	2.47	1.28	6	74	66	70	3.1	4.0	3.9	9,670	50	ne.	2	3	10	4	9	7	14	6	7	2		13	13	5	8
Aug	4.52	1.92	23	77	72	74	3.7	6.2	4.7	9,228	48	ne.	23	4	12	3	9	5	15	4	9	1		10	14	7	10
Sept	.32	.20	2	68	64	66	3.1	2.3	2.2	10,184	40	sw.	28	3	7	2	10	10	14	7	5	2		20	9	1	4
Oct	.36	.21	6	73	60	67	5.9	2.6,	4.3	12,899	46	ne.	26	5	5	2	8	10	12	6	13	1		13	11	7	5
Nov	3.83	.84	8	81	77	79	7.5	6.3	7.2	14,425	51	s.	19	4	9	0	6	11	8	14	8	0		6	5	19	11
Dec	1.32	.56	6	78	76	77	6.4	5.2	5.2	15,935	57	se.	1	2	5	0	12	16	16	9	2	0		11	9	11	9
Year	26.54	1.92	....	78	72	75	5.4	5.1	5.2	145,028	60	sw.	......	56	133	38	110	83	136	89	77	8		119	122	124	118

TABLE LIX.—*Mean monthly dew-point.*

Month.	1883.				1884.				1885.				1886.				1887.				1888.			
	A. M.	P. M.	Night.	Mean.	A. M.	P. M.	Night.	Mean.	A. M.	P. M.	Night.	Mean.	A. M.	P. M.	Night.	Mean.	A. M.	P. M.	Night.	Mean.	A. M.	P. M.	Night.	Mean.
	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°	°
January	9	10	8	9	9	14	9	10	15	18	18	17	9	12	12	11	9	15	12	12	5	10	10	8
February	11	15	15	14	17	21	18	19	19	22	23	21	7	16	12	12	21	24	22	22	14	18	17	16
March	18	18	19	19	23	26	24	24	28	30	31	30	21	25	24	23	23	25	26	24	20	24	22	22
April	33	33	34	33	33	33	34	33	43	45	44	44	37	38	39	38	33	34	35	34	30	33	33	32
May	42	41	42	42	44	45	44	44	46	48	48	47	42	42	44	43	48	48	48	48	41	42	45	43
June	54	55	55	55	55	56	56	56	56	56	57	56	55	55	56	55	56	56	56	56	54	55	55	55
July	59	60	61	60	58	58	59	58	60	60	62	60	63	64	64	64	62	65	63	63	60	......	61	60
August	56	57	58	57	57	56	58	57	62	62	63	62	58	57	60	58	57	58	58	57	56	......	57	56
September	49	49	51	50	57	57	59	57	55	55	57	56	53	54	55	54	52	52	53	52	46	......	48	47
October	42	42	42	42	45	47	46	46	44	48	48	47	41	42	43	42	36	39	36	37	36	......	40	38
November	29	32	31	31	30	34	32	32	29	32	31	31	33	35	34	34	27	30	28	28	32	......	36	34
December	19	24	21	21	21	24	23	23	17	21	17	18	24	28	26	26	20	23	23	22	25	......	27	26
Year	35	36	36	36	37	39	39	38	40	41	42	41	37	39	39	38	37	39	38	38	35	......	38	36

TABLE LX.—*Grains per cubic foot of moisture in the air.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Year.
1882	1.53	2.07	2.16	2.55	3.08	4.98	5.20	6.41	4.83	3.89	2.33	1.24	3.36
1883	.81	.98	1.22	2.23	3.04	4.86	5.76	5.17	4.05	3.10	2.01	1.39	2.88
1884	.86	1.23	1.56	2.23	3.35	5.00	5.45	5.27	5.27	3.54	2.13	1.46	3.11
1885	.88	.90	1.48	2.66	3.18	4.87	6.50	5.45	4.70	3.10	2.32	1.67	3.14
1886	1.14	1.38	1.94	3.28	3.73	5.12	5.86	6.26	5.00	3.65	2.04	1.20	3.38
1887	.90	1.44	1.57	2.28	3.80	5.04	6.44	5.27	4.40	2.57	1.85	1.42	3.08
1888	.78	1.10	1.43	2.14	3.15	4.85	5.84	5.13	3.64	2.66	2.29	1.67	2.89
1889	1.51	1.02	1.91	2.62	3.37	4.73	5.83	5.24	4.20	2.74	2.19	2.18	3.13
1890	1.67	1.67	1.35	2.38	3.08	5.76	5.38	5.20	4.38	3.43	2.13	1.47	3.16
1891	1.54	1.42	1.61	2.66	2.97	5.38	5.03	5.57	4.86	2.76	1.74	1.82	3.11
Mean	1.16	1.32	1.62	2.50	3.28	5.06	5.73	5.50	4.53	3.14	2.10	1.55	3.12

TABLE LXI.—*Dates of first and last killing frosts at Chicago.*

Year.	First.	Last.	Year.	First.	Last.
1873	Oct. 23	....	1883	Oct. 1	Apr. 24
1874	Oct. 31	Apr. 24	1884	Oct. 23	Apr. 2
1875	Oct. 2	May 2	1885	Sept. 1?	May 10
1876	Oct. 4	Apr. 30	1886	Nov. 8	May 21
1877	Oct. 22	Apr. 30	1887	Oct. 11	Apr. 25
1878	Oct. 19	May 13	1888	Oct. 3	May 15
1879	Oct. 20	Apr. 3	1889	Sept. 27	Mar. 30
1880	Oct. 18	Apr. 12	1890	Oct. 27	Apr. 14
1881	Oct. 19	Apr. 7	1891	Oct. 22	Apr. 8
1882	Nov. 3	May 25	1892	....	Apr. 24

ABSTRACT OF DAILY JOURNAL, CHICAGO, ILL.

1870.

November 25.—Slight aurora.

November 30.—One certain forerunner of all storms here seems to be a strong current of air from the west or southwest, in the former case swerving by the north, in the latter by the south. In the former case the storm will attain its maximum when the wind reaches the northeast, in the latter when it reaches the southeast and east.

1871.

February 24.—The wind of to-day was the most violent that has been experienced at Chicago since November, 1860. Its rise and fall were equally sudden. At 7 a. m. its velocity was 26 miles; at 10 a. m., 32 miles; at 12.15 p. m., 48 miles; at 3 p. m., 32 miles; at 4 p. m., 21 miles per hour. This storm, and that of January 13, go to prove that the Rocky Mountains do not, as has been generally supposed, prevent meteorological conditions from acting on their movements.

March 18.—There was a considerable auroral display to-night.

April 9.—An aurora was visible at 7 p. m. Increasing in brilliancy, at 9 p. m. it exhibited the most magnificent auroral display which has been witnessed in Chicago since this office was opened. It consisted of the usual streamers and dark band underneath.

April 13.—At 9.15 p. m. the aurora divided itself into two distinct parts, and a band resembling a curtain, and extending from one horizon to the other, rose to about 55°. At 9.35 p. m. this separated portion had risen so high that its lower part was at the pole star. The whole was in rapid motion from east to west. There was very little of that shooting motion sometimes so marked.

May 16.—Rain commenced at 5.15 p. m., accompanied with thunder. At this time a cloud of intense blackness, brilliantly illuminated with lightning, hung over the southern portion of the city, and a tornado of great fury for this latitude passed over Bridgeport (a southern suburb), causing considerable loss of life and property. Only the outskirts of the storm passed over the city. The force of the wind may be illustrated by the newspaper report that it lifted a house, carried it 300 yards, and deposited it in a ditch.

May 25.—Thunderstorms traveling about all day. To-day has well illustrated what, from the experience of the past few weeks, appears to be a fact. Cumulus clouds, whether discharging rain or not, which approach the lake from the land grow developing, or at least maintain their proportions until they reach the margin of the lake. Then they dissipate, and what an hour before was a dense cloud becomes reduced to a few filaments. Day after day, with the cumulus clouds traveling from the southwest, have I seen them standing about like giants over all the land and around the shores of the lake, while over the lake the sky was entirely free of cumulus clouds.

June 23.—The rain commenced at 7.15 p. m. At 7.20 a hurricane sprang up from the northwest; this continued till 7.40, doing considerable damage to trees and houses. The rain during this time, combined with the spray, presented very much the appearance of a snowstorm, so dense was it. At 7.45 p. m. the rain nearly ceased; the amount which had fallen between 7.15 and 7.45, as measured by the Signal Service rain gauge, was 1.93 inch.

July 14.—A brilliant aurora manifested itself a little before 11 p. m. The streamers and dark cloud beneath were exceptionally well defined. There was very little apparent lateral or perpendicular motion. The height of the highest part was about 60°, and the height of the lowest extremities of the streamers about 20°. It presented at 11 p. m., when brightest, very much the appearance of a curtain.

July 15. The temperature rapidly rose till noon, when it marked 85°; a northeast wind then sprang up, and at 4 p. m. the temperature had fallen to 73°. During the time that this cooling process was going on, a severe storm kept moving along the southern horizon. A slight shower occurred here. The storm evidently took place when the northeast wind which had sprung up at noon met the southwest wind which it was displacing. This cool Arctic current, as shown by the p. m. reports, came down over the whole Lake country simultaneously. This rapid cooling, from the north, produced great differences of temperature within very limited areas. At 4 p. m. the temperature was 72° at Indianapolis, while at Saint Louis it was 100°. At New York the temperature was 73°, at Baltimore 93°; at both Indianapolis and New York great storms took place. The barometer in neither case showed unusual symptoms.

July 21—Aurora during the evening. The brightness was not strongly distinguished from the darkness, but long bands of darkness, apparently caused by bands of this cirrus cloud, stretched into the brightness.

July 22.—Slight aurora, consisting of bright isolated streamers without any other auroral accompaniment, shading far up into the sky.

July 23.—Very cool for the season. Since the 18th the thermometer has not reached 80° till to-day. From the evidence of this month alone, it could be held that auroras herald and accompany cold weather.

July 26.—At 3.40 p. m. rain commenced; the wind changed from southwest to northwest at 3.50 p. m. and from northwest to northeast at 4 p. m. During a few minutes before 4 p. m. large hail of about three-quarters of an inch in diameter fell scatteringly amid the rain. The outskirts of the shower only touched the observer's office, but to the north and northeast a severe hailstorm took place, breaking a large amount of window glass. At 7 p. m. a heap of hail 1½ feet deep lay beside a church in the northern part of the city. The hailstones were remarkably smooth and regular. A mile south, I understand, there was neither rain nor hail. The storm was wholly caused by the cold northeast wind coming into antagonism with the warm southeast wind. From the roof one could see, by the smoke, that the extent of the storm was precisely the same as that of the northeast wind. That this violent storm was wholly produced by the contact of masses of air of very different degrees of temperature, and *not* by any differences of pressure, is shown by the fact that the thermometer fell from 84° at 3.53 to 70° at 4.05 p. m. The barometer had been falling somewhat, but manifested no unsteadiness on its suddenly passing into a much colder stratum of air. The clouds from which the hail fell were of great elevation. The sky had been remarkably transparent during the day, rendering the sun's rays exceedingly powerful.

July 31.—The month just gone is spoken of by everyone as being one of the coldest ever experienced in Chicago.

August 10.—At 11.15 p. m. a flash of lightning struck directly over the city, dividing, and did so, into a great many branches. The report was instantaneous, and consisted of a sharp cracking sound. As soon as the cloud came over Lake Michigan the dis-

it and the earth became much more frequent—almost continuous—the

n a nearly perpendicular stream.

Slight auroras.

y day, with wind from northeast. Northeast is supposed to be the

This is undoubtedly the case during the spring and winter, but

is cooling and the lake warm, it is not so much so.

th onward the thermometer only reached 80° on two days,

each 70°. The coolness has been undeniably due to the prevalence of northeast winds. Thirty-two of the 155 observations were northeast and 25 were east. Even an easterly wind gets considerably cooled by passing over the lake. The northerly winds have been almost invariably accompanied or preceded by auroras.

September 5.—Warm day, 87°. Cirrus and cirro-cumulus clouds during the afternoon from west-southwest. A very bright auroral display took place during the evening.

October 16.—Took possession of new office, No. 10 W. Randolph street, yesterday. Have been without records from October 8 until to-day, everything official having been destroyed by the great fire, October 8 and 9. The observation at 10.53 p. m., October 8, was taken and transmitted as usual. At half past 9 an alarm of fire was rung. There had been a very large fire the preceding night, which was subdued with difficulty. The weather was intensely dry, and the wind blowing from the south-southwest with a velocity of about twenty miles per hour. Accordingly when by 10 o'clock p. m. the fire had increased instead of diminishing, many people turned out to see it, not from alarm, but simply for the sake of the spectacle. At 10.30 the fire was still confined to two blocks, with a strong hold of only one. The firemen at this time seemed to have a fair chance of checking it, still the burning was so great as to enable one, by the light of it, to read the time on the city clock, one and a half miles distant. The wind was carrying the sparks right through the center of the city, the line lying only two blocks west of the city hall. Still no one felt alarmed, except those in the immediate vicinity. I myself was present, and had seen the much larger fire of the preceding night checked by the river. By 12 p. m. the fire had increased considerably in area and intensity, but as the wind was south-southwest, and the river ran due north and south, there seemed as yet but little danger for anything beyond the river. Hitherto the fire had been propagated, and with no great velocity, merely by contact with the flames, but toward 1 a. m. the heat had become so intense as greatly to increase the power of the wind in the immediate neighborhood of the flames. This was especially the case on the east and west of the fire toward the front, the wind blowing straight toward the fire in all directions. Within forty yards of the blaze I estimated the wind blowing from the east toward it at thirty miles per hour. This caused a decided whirling motion in the column of flame and smoke, which was contrary to the hands of a watch.

Blazing pieces of timber of considerable size were now whirled aloft and carried to the north-northeast, starting new fires as they fell. These new fires being in the line of the smoke were invisible to those at the old fire. One of the fires was on the east side of the river, only a few blocks from the courthouse. By 2 o'clock the courthouse, with all the beautiful buildings around it, was in flames. The conflagration was now proceeding in the line of the wind as fast as a man could walk. By 3 a. m. the waterworks, two miles to the northeast of the courthouse, were burned. The city having thus been divided in two by a sheet of flame, the fire continued to work its way more leisurely to the east and west at right angles to the wind, as well as right in the teeth of it. The fire on the night of the 7th alone saved the west division. It had burned two blocks in breadth down the west side of the river. The fire on the 8th originated only a few blocks further south, hence it could not progress north for want of material. On the east side of the river, in the south division, the fire continued to work toward the east; this it did with the greatest rapidity at the southern limit of the conflagration, because there the unburned houses broke the wind and caused a back current at the base of the buildings. As soon as the fire had thus got a new swath of houses before it, and the wind behind it, away it went tearing, thus sadly surprising many who were congratulating themselves because the first rush of flame had spared them.

The Tribune people thought the strength of their building had saved them, because it lay at the extremity of one of the swaths. The next one took it. In the north division the first rush of the fire reached the lake, and then worked its way westward to the river. This it did not accomplish before 12 noon on the 9th. The wind had by 9 a. m. increased to perhaps twenty-five miles per hour, at the distance of three miles to the southwest of the fire. In the immediate vicinity of it, and especially in the streets running east an

May 24.—An aurora was observed at 8.45 p. m. It consisted at first of pale streamers of small brilliancy, reaching as high as the pole star, and having a horizontal motion from east to west. No shooting motion observed.

June 10.—An aurora, consisting almost entirely of a diffused light, was observed at 8.30 p. m., and continued with little change until midnight, when observations ceased.

July 3.—At 11 p. m. a faint aurora was observed. It consisted of an auroral light, extending only a degree or two above the horizon, and streamers. The streamers, in patches of different intensity, extended from northeast to northwest and reached as high as the pole star. They were nearly stationary as regards horizontal motion.

July 7.—At 8 p. m., while yet the light of the sun lingered in the northwest horizon, a reddish light was observed in the northeast. As the light of the departing sun became fainter this showed itself to be an aurora, which occupied the whole northern horizon from the northwest to the northeast. The reddish light had meanwhile given way to a uniform pale light. The aurora consisted of a dark band of about 3° in height, a bright arch of dim light surmounting it and raising it to about 20°, an occasional streamer reaching down to the horizon and extending to about 25° in height.

July 8.—At 9 p. m. an aurora was observed. When first seen it consisted of streamers rising to nearly the height of the pole star, a circle of pale uniform light of considerable brightness, and the usual dark band beneath. Cirro-stratus in small quantity stood out in clear relief from the aurora.

July 10.—An aurora of small proportions at 10 p. m. was partially visible, the northern sky being partially obscured by clouds. As far as seen, it consisted entirely of streamers and reached to about 30° height.

August 3.—Aurora visible from 8.45 p. m. till about midnight. Most brilliant at 9.15, at which hour a narrow streamer of pale color extended from the horizon to the zenith. A dark segment was very plainly visible, extending from the west of north to the east point, and above the heavens were illuminated to the height of 25°.

August 8.—Faint auroral light at 8 p. m. beginning to make its appearance, dark segment along the northern horizon. At 9 p. m. aurora more bright and distinct; appears now as an arch of pale straw color, extending from west of north to north of east and about 15° in altitude; 9.30 p. m., aurora suddenly looms up very brilliantly, and extends from west of north nearly to the east, streamers extending to various heights, some reaching the zenith. The colors are very bright and varied, some of a green, others violet, and on the extreme eastern corner a diffused red; 10 p. m., a very singular and beautiful arch of light, of a white color, suddenly shoots up from about 20° above the southeast horizon, extending to about 70° above the western horizon and drifting with the south wind. This arch is so dense that it obscures the stars behind it. It continued about ten minutes and then gradually disappeared, commencing in the east. The illumination in the northern sky has now assumed a bluish shade, and above the dark segment (which is now black) resembles the folds of a curtain gently fanned by a light breeze. Pale violet streamers still extend nearly to the zenith; 10.30 p. m., sky partly obscured by cirro-cumulus clouds and aurora not so bright; midnight, clouds have cleared away and aurora is as bright as ever; 1.30 a. m., complete corona, streamers all joined at zenith; 6 a. m., the auroral display continued until daylight, and the number of shooting stars, especially between 2 and 3 a. m., are very unusual.

August 14.—Faint aurora first noticed at 10.10 p. m.; faint white or pale yellow beams (or streamers) shot up from the usual dark segment (about 30° above the horizon) nearly to the zenith and extending from a little west of north to the northeast. These
ners rapidly became more brilliant, and by 10 p. m. had extended from the north-
early to the east and shot up beyond the zenith. At 11.45 a complete corona
ible, and the sky exhibits a great variety of tints. About 25° above the horizon
ora assumed the appearance of a brilliant curtain of frequently changing
me portions of the sky being white, others green, others straw color, and now
ther in the northeast or northwest) a rosy hue deepens to a crimson, and at

one time to a blood red. The beams were in constant motion, and waves of bright light traversed the sky continually, both from the east to west and from the horizon to the zenith.

September 4.—Faint aurora visible.

September 5.—A brilliant meteor was observed at 8 p. m. Its first appearance was a little north and east of the zenith, moving in a direct line, about 20° south of east. A line of bright white light showed its course, and remained several seconds after it had passed. When it had reached about a third of its distance it went out almost for a second or two then brightened up and moved on in the same line, then for a second time disappeared for several seconds. It was then renewed again brighter than ever, and still moved on in the same direction until it finally disappeared entirely. This white light was intensified now and then with a shade of red. The entire display lasted nearly half a minute.

August 7.—At 11.12 hail of very large size fell continually for about five minutes. As the storm set in the barometer rose rapidly and the thermometer fell from 78° to 67°, and was as low as 64° during the continuance of the hail.

September 24.—Barometer falling and southerly wind continues, and at noon is blowing a gale (50 miles per hour) accompanied by light rain.

October 13.—A few flakes of snow fell at different times during the day; the first of the season.

October 14.—A very brilliant auroral display, first noticed at 9.30 p. m.; it lasted till midnight and showed to the greatest advantage at about 10.20 p. m., when converging rays of a variety of hues, from a rose color to a vivid green and purple, extended nearly from east to west and almost to the horizon.

October 18.—Faint aurora, first noticed at 12.03 a. m., increased in brilliancy very rapidly and was at its maximum at 12.30 a. m., when an arch of white to purple-violet color extended from northeast to northwest, in the latter direction assuming a rosy hue; this arch was about 45° in height, and streamers in constant motion (of pale color) extended nearly to the zenith. At 1.15 a. m. aurora had disappeared.

1873.

January 23.—Barometer falling at 7 a. m., with sky covered with stratus clouds of a threatening aspect. At that hour a brisk wind was blowing from the northeast and at 7.30 a heavy snow, in small flakes, began falling. Thermometer stationary at 23°. The wind increased in velocity during the day, reaching a maximum velocity at 8 p. m. of 36 miles. The snow continued to fall in blinding drifts during the day and night, at times being so heavy as to fill the air completely and obstructing the vision at short distances.

The oldest inhabitant declared that he had never witnessed such a storm. Sufficient snow was collected in the gauge to measure .05 inch; the amount which fell was estimated at from 5 to 6 inches, or .50 to .70 inch melted. The persistency of this storm was something remarkable, extending, as it did, without cessation, over a period of 18 hours.

January 29.—Very low temperature early in the morning; the thermometer falling to 15° below zero.

February 4.—Beautiful display of zodiacal light from 6 to 7 p. m. The light was of a brilliant crimson, deepening in shade near the horizon, and generally fading into a pale yellow until lost in the sky. No line of demarkation could be traced, but the light was visible in the center of the arch to a height of from 15° to 20°.

March 26.—The storm continued with scarcely unabated severity until daylight, the wind reaching a velocity of 38 miles per hour at 1.30 a. m. Snow fell until 8.30 a. m., and the wind began to decrease in velocity. At this hour the depth of the snow, in drifts on the streets, was from 2 to 6 feet.

April 6.—Rain began to fall at 6.30 p. m., and a thunderstorm of considerable violence from that hour until 10.30 p. m. The flashes of lightning were very vivid, and mostly of the variety known as sheet lightning. Occasionally a flash of zigzag lightning was seen, with an accompanying peal of thunder. This is the first marked thunderstorm of the season and occurs in conjunction with a very high temperature (83°) and a brisk south-southwest wind.

May 1.—Thunderstorm during the evening, accompanied by heavy rains and brisk northeast winds. The largest amount of rainfall during any eight hours of the year up to this date was from 4 p. m. to midnight. Very heavy peals of thunder and vivid flashes of lightning characterized the storm.

June 18.—At 9 p. m. the first indication of an aurora made its appearance in the northern heavens, continuing to increase in size and appearance until 11 p. m., at which time it attained its maximum proportions. The display rose from a dark segment extending 15° each side of the magnetic meridian, and first consisted of a poorly defined whitish hue, but gradually increased in brilliancy until it assumed the pale red color peculiar to such displays, while well defined beams of great brilliancy commenced shooting upward from the western side, attaining an altitude of 45°, and gradually passing over the segment to the eastern extremity.

September 5.—The account of yesterday's blow given by this morning's papers makes it of far more serious nature than could be anticipated by parties in the city. All the captains of vessels that came into port last night speak of it as a hurricane, lasting about an hour, and doing great injury to all the vessels that encountered it. A peculiar feature of the storm is that, while the papers all speak of it as being from the south over the lake, it was from the west over the city, another where one of the vessels encountered the sea running from the southeast, while the wind was from the southwest.

September 15.—After midnight the wind, which had been blowing from the south, shifted to southeast, and commenced to blow a gale, increasing in strength until about 8 a. m., when it commenced to moderate, and then decreased gradually until 5 p. m. During its continuance over the city a number of roofs were torn from buildings and walls of others being erected torn down; the damage in several sections amounting to thousands of dollars. The wrecking of the Ironsides, a steamer plying between Milwaukee and Grand Haven, by that blow caused the loss of a number of lives and one of the finest vessels on the lake.

September 19.—The first frost of the season occurred during the past night.

September 30.—A review of the past month reveals the fact of its having been the most disastrous one on shipping that has occurred for some years past, especially for the season, while its varying changes have been such as to cause unusual comment by the press, seafaring men, and the community at large.

December 4.—Barometer fell .51 inch between midnight and 7 a. m. this morning, but the wind constantly increased, until at 6.35 a. m. it was blowing 38 miles per hour. Great damage was done by the storm in this city. Several buildings were unroofed, and some in process of construction blown down. Trains were all delayed, and several vessels tied to the docks were blown from their moorings.

1874.

March 3.—The first thunderstorm of the season, accompanied with brilliant lightning, broke over the city between 7 and 8 this a. m.

June 6.—A storm struck the city and was the most violent, and, in some respects, the most remarkable that has visited this city for some years, as regards the heavy rainfall, the display of lightning, and the total absence of wind. The storm, which came from the west, moved slowly. It began raining about 8½ miles south of this office at 7 p. m., and rained in torrents for nearly two hours, during which time, although the sky was clouded and sheet lightning incessant, no rain fell in the central part of the city.

t 21.—5.15 p. m. wind suddenly shifted to north and was followed by one of est rainfalls witnessed in this city for some years; 2 inches falling from 5.30 to during which time the temperature decreased 19°.

3.—At 9 p. m. an auroral light first made its appearance in the northern It first assumed a bright whitish color, retaining it until 11.30 p. m., when the color changed to a reddish cast, and bright flames shot forth from the luminous mass, extending to an altitude of 45°; this continued until midnight, up to this time the azimuth of the display did not exceed 30°.

October 4.—The auroral display ceased at 3 a. m., having after midnight attained an altitude of 75° and an azimuth of 45°.

November 2.—The change in temperature from 31°, during early morning, to 65°, during middle of day, is the greatest daily change that has come under the notice of the observer since the establishment of this station.

1875.

January 8.—The temperature decreased from 31° at 4 p. m. to 15° below zero, a change of 46° in 8 hours. A change said to be unprecedented in this section in years past.

January 9.—During the night the thermometer showed the temperature to be 20° below zero, while thermometers in various parts of the city ranged as low as 30° below, according to locality and exposure. It is said to be the coldest night experienced in this city for years past.

January 24.—Between the hours of 9 and 10 p. m. the rising moon presented a very peculiar appearance, seeing it as it was rising from the lake. From some cause in the atmosphere its rays seemed entirely concentrated into a vertical belt of the same width as the moon, and extending above and below about 5°.

This peculiar concentration of the rays was probably due to the amount of moisture in the air over the lake, for the concentrated rays gradually expanded into proper form as the moon continued to rise.

February 1.—Two bright, luminous spots, one on either side of the sun, were visible for a short time this morning at early sunrise. These are what are termed "sun dogs."

February 3.—The wind from 2 to 4 p. m. was blowing at the rate of 40 miles per hour. From 4 p. m. it abated, but still continued high until after midnight. So high a wind has not been experienced in this locality since the night of the great fire that destroyed the best portions of the city. Considerable damage was done to buildings throughout the city, and several vessels were torn from their moorings and badly damaged before being secured.

February 12.—Temperature 13° below zero this morning, and on the outskirts of the city as low as 20° below. The continued cold weather of the past six weeks has frozen the ground to the depth of from 4 to 6 feet, in some places freezing the main water pipes. A large number of service pipes have been frozen for some days, and great inconvenience is the result.

March 14.—At 8.55 p. m., and until 9 p. m., hailing, some of the hail being unusually large; one inch in diameter being the medium size.

March 16.—Gale continued until midnight. Considerable damage was done to buildings in course of erection, and to lighter objects exposed to its violence, but none to the shipping interests.

June 21.—The rainfall from 2.30 to 3.30 p. m. was unusually heavy, amounting to 1.55 inch.

June 23.—Between 2 and 3 a. m. a very heavy squall passed over the city from the southwest, doing considerable damage to buildings in course of erection, also injuring some vessels exposed to its fury. It was accompanied by rain, heavy thunder, and lightning.

July 15.—A very sudden and severe squall passed over the city between midnight and 2 a. m. The squall passed from northeast to southwest, and was accompanied by sever thunder and vivid lightning, but no rain. Yesterday afternoon Professor Donaldson a Mr. Grimwood, reporter for the Evening Journal, ascended in a balloon from Barn circus, and were blown out over the lake by the southwest wind. Fears are enterta that they are caught in the squall and probably lost.

August 5.—At 9 p. m. a very heavy squall struck the city, blowing for about five minutes at the rate of 45 miles per hour. A small quantity of rain fell at the same time. The heaviest of the storm passed to the southwest of the city, doing a great deal of damage to everything exposed to it, especially the crops.

August 7.—This morning's papers give a very distressing account of the damage done by the rain and storm of the 5th and 6th, and the loss to the farming community by the floods, the latter still continue; also accounts of several vessels being wrecked, but not in this vicinity.

September 9.—A very heavy rain commenced falling at 12.10 a. m., continuing until 8.30 a. m., commencing again at 3.40 p. m. and continuing until midnight; the total fall of the day being 3.50 inches, it being the heaviest fall for one day that has occurred in this city for months. At 6 p. m. the wind suddenly shifted from south to north, increasing in velocity until midnight, when it was blowing at the rate of 35 miles per hour. The fall of rain during the morning was accompanied by a brilliant display of lightning and heavy thunder. A fall of 24° from 2 p. m. to midnight.

September 11.—The worst fears of the disastrous effect of the storm of the 9th and 10th have been fully confirmed, and this morning's papers give a distressing account of the damage done, full particulars of which have been forwarded to O. C. S. O. by letter this day. Those exposed to the storm on the lake speak of it as the worst they ever encountered.

December 31.—The maximum temperature during the day was 68°, the highest that has been experienced for years. The same can be said for the whole month, the warmth of it being commented upon both by the public and the press.

1876.

January 31.—The past month has been remarkable for its warmth, the mean temperature being 15.5° higher than for January, 1875.

February 8.—Heavy thunderstorm commenced at 9 p. m., continuing until after midnight; bright lightning.

March 16.—At 12 noon the barometer had reached the lowest point in past two years, 28.965 inches (corrected), the fall in 24 hours being 1.101 inch.

April 28.—Warm and clear. Several steamers succeeded in forcing their way through the ice in the Straits of Macinac. This event is practically the opening of navigation.

May 6.—At 9.10 p. m. the city was visited by a violent tornado, which, though lasting but from two to three minutes, did damage in and about the city estimated at $250,000. The course of the tornado was from southwest to northeast, having a swift rotary motion from right to left, bounding along like a ball in its full force, apparently reaching the ground but two or three times. The last seen of it was on the lake in the vicinity of the "crib," at which place it demolished the fog bell and tower. It was also reported that numerous water spouts were seen in that vicinity at the time. During its passage the rain fell in torrents, and it was accompanied by thunder and sharp flashes of lightning. Many of the vessels in the lake were damaged to some extent.

September 26.—Aurora in the evening at 10 and ending at 3 a. m.; bright flashes of light from east to west, gradually fading out and then reappearing.

September 27.—A light frost was observed upon the walks this morning, the first seen in the city this season.

October 14.—The first snowflakes of the season fell to-day, but not in a sufficient quantity for measurement. The man at the "crib" telegraphed to this city at 9 a. m. that the wind at that place was blowing at the rate of 65 miles per hour and the waves were running 12 feet high. The wind at this station did not register over 24 miles per hour.

December 1.—The weather on the lake is reported as being very rough, and vessels arriving were thickly coated with ice. No vessels cleared during the day, and those that left yesterday were obliged to return for shelter. Vessels after arriving and unloading generally strip and tie up for the winter, and navigation has now practically closed at this port for the winter.

1877.

January 31.—The snow, which has been on the ground since November 30, has given 62 days of uninterrupted sleighing in the city, and is now fast disappearing.

March 20.—Heavy snowstorm commenced at 1.30 p. m., and at the same time several loud peals of thunder were heard.

April 2.—The southwestern portion of the city is badly flooded by water, caused by the overflow of the Desplaines River and canal. The low prairie is covered with water to the depth of several feet in some places, and considerable damage has already been done to streets and sidewalks.

April 3.—The flood in the southwestern portion of the city continued to increase during the night, and several large manufactories have been stopped by the water. The Chicago River is very high, and is discharging a rapid current into the lake, and many of the low docks and slips along the river are under water. The ice on the outer harbor and lake has disappeared, having been driven up the lake by the south wind. The muddy and impure water flowing from the river can be traced out into the lake for a distance of several miles and extends beyond the "crib."

June 20.—The propeller "Concord" succeeded in breaking her way through the ice in the Straits of Macinac at 2 p. m. to-day.

May 28.—A bright aurora during the evening was first observed at 8.15 p. m., brightest from 8.30 to 8.45, gradually growing fainter, and disappearing as the moon arose at 10 p. m. The arch had an altitude of about 25°, and from this bright streamers shot up to the zenith, and at times extended from 5° to 10° beyond that point. At times large bodies of light, of irregular cloud-like form, would appear in the east and disappear in the northwest.

May 25.—A violent storm of wind and rain passed over the station to-day.

July 2.—Heavy rain early in a. m., and at 5.45 p. m. a severe thunderstorm passed over the station, during which a few hailstones of a very large size fell.

October 11.—An aurora during the evening was first observed at 10 p. m. and lasted until 1 a. m. of the 12th. The brightest display being at 12.30 a. m. of the 12th. The altitude of the crown of arch was about 20°.

November 5.—The rain of last night turned to sleet and snow at 3.20 a. m., with a furious northeast gale. The schooner "Ohio" came ashore on the breakwater and was dashed to pieces. The "Gardner," "Coral," "Pennington," and "Chapen" were also beached in this vicinity, together with numerous other minor disasters.

November 9.—The schooner "D. G. Williams" struck the breakwater about midnight last night and went to pieces.

1878.

February 27.—Ice along the shore went out to-day.

March 6.—Heavy hailstorm reported at 2 p. m. in the suburbs 10 miles south of here. The storm is said to have lasted 20 minutes, during which time 1½ inch fell. The track was about 300 yards wide, and the hailstones were of an average size and uniformly globular.

March 17.—A squall lasting 15 minutes (10.30 to 10.45 a. m.) passed over the station, the wind attaining a velocity of 27 miles. No casualities reported.

March 24.—No vessels left this port while the signals were displayed, except the fore and aft schooner "Minnie Corbett," of Grand Haven, Mich. This vessel left port at 5 p. m. and attempted to weather the breakwater, but was compelled by the force of the gale and the heavy sea running to let go her anchors in the outer bay. During the night the gale continued to increase, sweeping the boat from her moorings and driving her bow on the breakwater, where she now lies breaking up piecemeal—a total wreck.

March 25.—The report of the keeper of the Life-saving Station at this port contains the following clause referring to the wreck of the "Minnie Corbett": "Her wreck may be attributed to the high wind and heavy sea from northwest to northeast, which caused her to drag her anchors; also to the want of caution in her commander in sailing from this port while the storm signals of the U. S. Signal Service were displayed."

May 24.—Down signals received at 9.50 a. m. Not justified, although in the immediate suburbs the wind blew a fierce gale, uprooting trees, unroofing several houses, and otherwise injuring much valuable property.

July 6.—A large and brilliant meteor was observed at 3.05 a. m. Was first seen within the constellation Ursa Minor, its direction being through the Corona, disappearing at the horizon a little south of Libra. This meteor was as large as the full moon, and while visible (about 12 seconds) gave a light of three times the intensity of the moon on a clear night. The "cloud" in the wake of this phenomenon was a pale luminous streak, covering the entire track of the meteor. It had no apparent motion, but disappeared gradually from west to east, and was entirely obliterated in 11 seconds.

July 26.—The rain of last night continued until 5.55 this morning, and is the heaviest shown by the records of this station. The greater quantity of rain (I should estimate two-thirds of the whole) fell between 11.30 p. m. of the 25th and 2.30 a. m. of 26th. The damage caused by rain would be a difficult matter to estimate, being so general throughout the entire city and suburbs. Railroads and culverts were washed out, cellars flooded, buildings in course of erection leveled, sewers choked (although their guaranteed capacity is for one inch rainfall per hour) and the streets and sidewalks more or less damaged. The total fall was 4.14 inches.

August 8.—A squall struck here at 2 p. m. which, though not attaining a velocity of more than 22 miles an hour at this station, must have reached at least twice that force on the lake within 10 miles of here. Every vessel within that radius lost some of her canvas; two yachts lost all their spars and rigging; a steamer and two schooners were driven aground on the northeast breakwater; one fishing smack was capsized, and several minor casualties are reported. The wind during this squall was from the southwest, but after the squall had passed the wind veered suddenly to the north, remaining there for 15 minutes, and again backing to the southwest. The temperature, meanwhile, dropped from 91° to 80° between 1.50 and 2 p. m. The barometer was remarkably steady, giving no premonition of this disturbance.

August 12.—Meteoric showers from 10.15 until midnight, from every quarter of the horizon. The number of meteors that fell (even for a fraction of a second) could not be computed. The display is considered one of the most remarkable ever observed here.

September 21.—Light hoar frost, the first this season, last night.

September 25.—Up signals received at 11 a. m. The heaviest rainstorm ever seen in this city swept over at 11.30 a. m., lasting 8 minutes. It was accompanied by sharp thunder and diffuse lightning, which illuminated the sheet of water that was coming down in a manner similar to an electric discharge on a plate of wet glass. The direction of the wind just before the storm was southerly, and a drizzling rain had been falling for some time. The wind backed suddenly to the west-southwest, and in less than thirty seconds the deluge came on. The streets in two minutes looked like so many canals; cellars were flooded in five minutes, and the houses on the opposite side of the street could not be distinguished, even in outline, through the semi-opaque mass.

A sprinkling of hail fell when the rain began to slack up, the stones averaging ¼ of an inch in diameter, irregular in shape, and with a formation of hard, transparent ice. The rain gauge at 11.40 a. m. showed a fall of .97 inch, .92 inch of which, I have estimated, fell in 8 minutes, being at the rate of nearly 7 inches an hour, or more than three times the guaranteed capacity of the city sewerage. The barometer had been falling rapidly nd steadily for 16 hours, and fluctuated very slightly during the storm.

November 2.—Signals hoisted yesterday, justified, wind 26 miles. All vessels remained port during the display; those caught out on the lake were roughly handled. Captain Saunders, of the bark "Kelderhouse," was lost overboard during gale. The bark "Woodruff" wrecked, and two of her crew missing. The schooners "American," "Australian," "Montpelier," and one unknown, were washed ashore, and the bark "Rutter" sunk, besides numerous minor disasters.

December 31.—The depth of snow on the ground at this date is about 14 inches.

1879.

January 31.—About 3 inches of snow on the ground at this date.

February 28.—About 25 inches of snow on the ground up to date.

April 1.—Navigation opened.

April 2.—Hard frosts at night.

April 10.—Geese flying north.

May 25.—Heavy rain and thunder storm commenced at 1 a. m. and ended at 6.30 a. m. There was no perceptible interval between the lightning flash and the thunder crash, and the fluid ran along every telegraph line in the city, destroying hundreds of instruments and other telegraph material, and ringing a general fire alarm at fire department headquarters. Fortunately no lives were lost, nor other property seriously damaged, owing probably to the great conducting power of the deluge of rain that fell during the fiercest interval. Several hundred cellars were flooded by the rain in the southern and western districts.

November 20.—A heavy gale pervaded the lake during the afternoon of the 19th and morning of the 20th, causing great damage to vessels. The schooner "Clara Parker" driven ashore at the foot of 30th street.

December 16.—Close of navigation for sailing fleet and steamboats.

1880.

February 29.—About 4 p. m. a peal of thunder and a flash of lightning accompanied by a small amount of rain.

March 10.—Hard frost during night. Wild geese observed flying in a northerly direction.

April 19.—Heavy wind storm at 2 a. m. Blew at the rate of 35 miles per hour for the first 15 minutes, lulled afterwards until 5 a. m., when it began again. Heavy peals of thunder and vivid flashes of lightning (zigzag) early in the morning, and at intervals up to dawn. Rain in heavy dashes, of short duration, at intervals up to about 7.25 a. m. Windstorm ended at 5 p. m. Maximum velocity 35 miles from the south. Much local damage reported.

Tabernacle and Plymouth churches were damaged by wind, the former having a chimney carried off, windows broken, etc., and the latter a part of the roof. No damage to shipping yet heard from.

May 25.—At 12.53 p. m. a sharp, sudden report was heard from the southeast, resembling considerably the report of a cannon, and Private Conrad reports that just at that time he saw, for an instant, a *ball of lightning.*

June 6.—Heavy thunderstorm early this morning, with brilliant sheet and zigzag lightning. Heavy windstorm from the southwest at 5.30 a. m., lasting until 4.30 p. m. No known damage in this vicinity. Much damage reported farther up the lake, maximum 36 miles.

August 12.—Clear weather. Aurora observed at 9 p. m., consisting of a dark segment on the northern horizon, clearly defined but slightly irregular in outline. At 9.05 p. m. segment disappeared and was immediately followed by a display of faint streamer shooting up towards the zenith, highest from a point due north, and extending 45° a 50° east and west of it. At times these streamers reached a height of about 75°.

August 13.—Aurora again observed at 8.25 p. m., which consisted of pale, ph phoresent, faintly-defined vertical shafts, extending upwards to about 80°, from a fai haze bank in the northern horizon, and from about 165° to 195° of azimuth. At times a feeble lateral movement from east to west was observed.

August 14.—Aurora recurred faintly at 12.18 a. m. Faintly defined shafts shot up about 30°. Faded at 12.20 a. m. Heat lightning in the northeast at 12.18 a. m.

September 29.—Light frost this morning. First observed at station this season.

October 1.—Heavy thunderstorm at 3.30 a. m., with brilliant zigzag lightning and frequent heavy rain showers up to about 6.30 a. m. Hail size of buckshot.

October 17.—Wind continued with but slight abatement up to 2.15 a. m. One unknown schooner reported sunk out in lake a short distance from port. Owing to timely warning given by signal, this is the only serious disaster yet reported to shipping in this vicinity. In South Chicago, "North Chicago Rolling Mills," partially built—walls 14 inches thick—were blown down, burying several workmen in the ruins. Part of Wheeler's new elevator, in course of erection, was blown down, also about one-half of Illinois Central elevator.

October 18.—The unknown schooner referred to yesterday found to be the "David A. Wells," which is reported to have gone down with her crew of 8 men.

October 19.—The steam barge "Trader," running between Chicago and Muskegon, was found waterlogged, with parts of works swept off. The crew were saved. The steamer "Alpena," which left Grand Haven on the night of the 15th, with about 60 persons on board, including her crew, is also believed to have gone down. She was seen by other vessels about 30 miles from Chicago. Fragments of wreck were picked up on eastern shore south of Grand Haven, marked "Alpena." The height of the waves and the fury of the storm is the subject of general comment even among old mariners.

1881.

February 27.—Heavy hail for a few minutes shortly after noon. Stones as large as ordinary peas.

March 19.—Windstorm from 4 a. m. to 11.15 a. m. Maximum velocity, 35 miles from the northeast at 7.35 a. m. Prevalent direction during storm, north. No known damage.

April 11.—Propeller "Oconto" arrived to-day from Milwaukee. First arrival of steamer. Navigation practically opened.

April 21.—Flood in Chicago River caused by overflow of Desplaines; southwestern portion of city inundated; considerable damage done to property.

June 29.—Heavy thunderstorm from 2 to 4 a. m., accompanied by heavy rain from 2.57 to 4.20, and heavy windstorm from the southwest at 2.55, lasting for 18 minutes. Maximum velocity, 32 miles.

July 20.—Heavy thunderstorm at 10.30 a. m., lasting about 1¾ hour, accompanied by heavy rain and brilliant zigzag lightning.

July 21.—Heavy thunderstorm early this morning, with unusually intense electric display.

August 3.—Highest temperature this year, 93.8°; a few cases of sunstroke.

August 4.—Highest temperature since 1874, maximum 97.9°.

September 13.—Aurora visible at 1.10 a. m., consisted of a faint arch of light of about 5° altitude, extending from about 8° west of the north point to 12° east.

November 11.—Rain from about 5.15 a. m., heavy in general up to about 8 p. m., when it changed to light; 3.18 inches up to 10.18 p. m.; inundated low-lying portions of [illegible]

1882.

[illegible]—Heavy thunderstorm early this morning, with very heavy rain at 1.30 a. m.

[illegible].—Windstorm continued up to 2.15 a. m. Schooner "Espanola," laden [illegible] route from Grand Haven to South Chicago, was wrecked off the harbor [illegible]ing.

April 16.—Aurora observed at 9.40 p. m. Consisted of a hazy segment about 15° high, surmounted by an arch of light about 5° broad, extending from about 40° east of north to 30° west. The arch slowly ascended, and at 10.15 was about 40° in altitude. During the next 10 minutes it widened towards both horizon and zenith and disappeared, leaving only a faint glow. About 10.30 vertical columns began to shoot up from near the north point towards the zenith, and were soon accompanied by similar displays in the west first, and afterwards in the east; the aurora, meanwhile, having extended laterally to about 55° west of north, and to about 70° east. The shafts gradually extended laterally, and finally converged to a point about 15° south of the zenith, changing in color from pale yellow to blue, red, and crimson.

About 15 minutes to 11 it attained its greatest brilliancy. The point of convergence near the zenith, a circular black nucleus presenting a decided contrast to the brilliancy of the converging beams which varied from a deep red at their summits to a pale blue near the horizon. At this time the display covered about two-thirds of the sky. At irregular intervals, a tremulous swinging movement was observed from east to west, and *vice versa*. About 10.55 it began to fade, and at 11.00 a faint glow remained, varied by occasional feeble beams shooting up towards the zenith from the horizon.

The wires of the various telegraph offices were unusually affected. At the Western Union office the batteries were detached and wires worked both to Omaha and New York, the current being very powerful. Wires running north and south were also much affected, but not nearly so powerful as those running east and west. Said to have been the most intense electric storm ever experienced in Chicago.

April 17.—Aurora continued up to dawn, was characterized by recurring fits, consisting chiefly of vertical shafts shooting up from the horizon with great rapidity and quickly disappearing, and a faint luminous glow resembling dawn.

June 27.—Heavy thunderstorm beginning at 4.40 p. m. and lasting for about an hour.

August 4.—Faint aurora at 9 p. m., extending from about 10° east of north to 35° west.

October 5.—Aurora at 9.15 p. m. A faint luminous glow on the northern horizon, extending from about 15° west of north to about 25° east of north, and in altitude about 25° at its center. At about 10.30 streamers, faintly defined, shot up from the north to about 35° in height, and slowly faded away. Soon afterward an auroral arch formed, extending from northwest to southeast, apparently about the breadth of an ordinary rainbow, but wider at its extremities.

November 13.—First heavy frost of the season this morning. Light flurries of snow from 2 to 7.40 this morning. First snow of the season.

November 17.—Rain at 4 a. m. Remarkable intensity of atmospheric electricity reported by various telegraph companies in the city. Evidences of aurora at intervals during the evening, seen faintly through occasional rifts in clouds. It consisted of a pale light and was soon obscured.

November 18.—Auroral evidences again observed early in the morning, consisting of a bright light at intervals through spaces between the clouds.

November 20.—Diffuse auroral lights visible from behind cumulo-stratus clouds between 2 and 5.10 p. m., extending in altitude to about 30° and in azimuth from about 150° to 240°. No special characteristics visible, merely a luminous glow at the summit, with the base obscured by clouds.

1883.

January 22.—Clear, with intense cold; animals freezing at stock yards and suburban towns. Minimum 17.2° below zero; maximum 3.8° below. Coldest weather recorded since January, 1879.

April 23.—Storms very severe on Lake Michigan. Several vessels left port af signals were hoisted, and were obliged to put back. Others arrived with loss of s and canvas. Schooner "S. Bates" went ashore at Winnetka (12 miles distant)

haze bank [illegible]
a feeble [illegible]
August 30° [illegible]
about [illegible]
Septem[illegible]
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[illegible] supposed to have gone [illegible]

[illegible] and at sunset.

[illegible] The season just closed [illegible] with exception of [illegible] and in the latter to 120. [illegible] losses on hull [illegible] of this loss, $991,915 [illegible] loss was the steam- [illegible] and 4 of her crew went [illegible]

[illegible] since the 9th was extremely

1884.

[illegible] at time, 50.5°. The [illegible] to the importance

March 14.—Larks and robins seen in the suburbs. Ice 19 inches in thickness in the Desplaines River, now being cut.

March 24.—Navigation resumed on Lake Michigan.

June 22.—Heavy thunderstorm from 2.30 to 4.55 p. m.

July 24.—A heavy thunderstorm from 4 to 8.45 a. m., accompanied by a brisk wind.

December 18.—Coldest day of the month. Temperature remained below zero all day, mean —6.6°.

1885.

February 10.—No mails received to-day. The temperature remained about 10° below zero all day, going down in the evening.

February 11.—Minimum temperature, —13.7°; the lowest for any February since establishment of station.

May 24.—A thunderstorm occurred from 3.30 to 3.50 p. m. The storm approached the station from the southwest and went towards the north. The temperature, which was 69° before the storm, rapidly rose to 80° after it had passed. The wind was from the east before the storm, shifted to southwest afterwards.

June 2.—A thunderstorm in evening, beginning at 6.12 p. m. and ending at 6.53 p. m. The temperature just before the storm was 75°, wind southeast. As the storm approached the temperature rose rapidly, marking 80° as the storm broke over the city. The wind veered rapidly from southeast, southwest, and west, remaining between south and west during the storm, but backing to the southeast as the storm passed to the east; the temperature rapidly falling to 70.9° at the same time. Sharp lightning and heavy thunder accompanied the storm.

June 3.—A thunderstorm ended at 2.15 a. m. There was no thunder heard or lightning observed after midnight. The rain gauge overflowed, and the 7 a. m. measurement was made from the snow gauge, showing a fall of 2.90.

June 7.—About 8 p. m. the sky, which was clear a moment before, became rapidly covered with clouds, and the temperature fell from 86° to 62° in 20 minutes, at the same time the wind increased to brisk and veered from the southwest to north.

June 21.—Light rain at intervals from 7.30 a. m. to 12.45 p. m. A thunderstorm prevailed during the latter part of this rain. It came from the southwest and moved towards the southeast.

July 4.—Hail began falling at 2.05 p. m., hailstones were round and about ⅛ inch in diameter.

July 7.—A sharp thunderstorm from 5.50 to 6.20 p. m. It came from the southwest and went northeast. A slight hailfall from 6.05 to 6.06 p. m.; stones about ¼ inch in diameter.

July 9.—Thunder was heard between 12.15 and 4 a. m. This storm came from the northwest and went towards the southeast. Temperature 81°, wind southwest before, and 71°, southwest after the storm.

July 14.—Thunderstorm from 8.40 to 9.30 p. m., with heavy rain. It moved from west to east. Temperature 80°, wind southwest before, and 75° and west after the storm. The lightning was very vivid.

July 19.—A thunder shower passed north of the city from west to east. A single clap of thunder was heard at 11.20 a. m. At 11 a. m. the wind was southwest, temperature 85.6°; at 11.40 a. m. (sky overcast and threatening) wind east, temperature 66.7°.

July 23.—A thunderstorm came from the west and went eastward.

August 2.—Decidedly low barometer. Lower temperature. Fresh easterly wind, increasing to brisk by noon, and blowing a gale during the afternoon and evening. Rain began at 12.50 a. m. and continued without intermission (generally heavy) all day. In the first 8 hours .14 inch fell, in the next 8 hours 1.64 inch fell, and the last 8 hours 3.85 inches fell, making the total for the day 5.63 inches. Sewers were filled.

August 21.—Thunderstorm. At 3.50 a. m. thunder southwest.

August 23.—Thunderstorm during early a. m. Light rain began at 3.15 a. m.

September 15.—Though not noticed at the station, it was learned that a bright aurora was seen by persons in the country adjacent. It began at 9 p. m. and ended about midnight. There were some streamers and merry dancers.

October 4.—Killing frosts reported from the adjacent counties.

October 8.—The sun rose very red at 7.06 in a clear sky. Fresh northwest wind, fair and clear weather. The sun set in cumulo-stratus clouds which were brilliantly colored with red.

October 29.—Incoming vessels report a severe gale on Lake Michigan. Nothing going out of this port. The severest storm of the season.

November 4.—Thunderstorm moving from southwest to northeast. First thunder 6.20 a. m.; loudest, 7.15 a. m.; last heard, 7.20 a. m.

December 9.—During the early morning there was some lightning. A single clap of thunder heard at 7 a. m.

1886.

January 13.—River and harbor frozen. Harbor covered with ice of considerable thickness. Ice on Chicago River is about 6 inches thick.

March 4.—Bishop's ring visible in afternoon; it was 15° in diameter and gray colored, slightly partaking of pink.

March 11.—A flock of wild geese was seen flying northward during the morning.

March 18.—Bluebirds and robins were to-day observed in the vicinity of the station.

March 20.—Captain Rogers, of the propeller R. B. Taylor, which arrived to-day, says that navigation is open so far as the upper part of the lake is concerned. Thunderstorm began at 5.25 and ended at 5.40 p. m. Immediately after the loudest report unusually large drops of rain began to fall, but soon resumed their normal size.

March 26.—Bishop's ring of a faint purple hue and of about 15° radius was observed in the afternoon.

April 2.—Bishop's ring visible in morning and afternoon, of a grayish pink color, 15° radius. Northwest wind with cloudy weather; clear in the evening.

April 16.—Navigation now opened. A large fleet of vsssels left port for the straits to-day.

April 21.—Vessels are reported to have forced a passage through the ice in the Straits of Macinac to-day, and navigation between the upper and the lower lakes may therefore be regarded as now open for the season, being a fortnight earlier than last year.

April 25.—Several vivid flashes of lightning and heavy thunder about 3.40 a. m.

May 4.—Thunderstorm began at 12.45 p. m. and ended at 3.25 p. m.

May 9.—First thunder heard in the northwest at 11.55 p. m. Wind east, temperature 56.2°. Loudest thunder from 12.35 to 1 a. m., and again at 3 a. m.; last thunder at 3.45 a. m. Hail fell from 7.30 to 8 p. m. The stones were not large nor numerous; now and then, however, a large jagged piece of ice was noticed. During the hail the loudest thunder was heard.

May 12.—At 5.15 p. m. a heavy thunderstorm was seen approaching from the southwest. Hail began at 5.43 p. m. The stones were composed of pieces of ice coated with snow, varying in size, some being as large as a hickory nut, while others were smaller. Hail ended at 5.46 p. m., with heavy rain.

May 17.—A mirage was reported as seen over Lake Michigan at 4 p. m.

June 5.—Rain began at 2.45 p. m., ended at 3.20 p. m. Hail began at 3.05 p. m. and ended 3.07 p. m.

Heavy frost was reported about five miles northwest of the city. Potato vines
killed.

st thunder was heard 12.40 p. m. The storm moved from west to east.

st thunder 4.30 p. m.; last, 5.20 p. m. Hail from 4.45 to 4.55 p. m.
large and irregular, some being as large as walnuts. Several were

noticed of irregular oval shape, with the long diameter of about 2 inches and the short diameter about 1½ inch, and having sharp, jagged points projecting from all sides. Most of the stones were formed of solid ice, and some were noticed which did not melt for an hour after they had fallen.

August 28.—At 8.30 p. m. lightning was seen in the western clouds, and at 9 p. m. the first (and very heavy) clap of thunder was heard. Loudest thunder heard at 9.42 p. m.; last, 10.45 p. m.

August 29.—Thunderstorm.

August 31.—At 10.01 p. m. a shock of earthquake was observed while reading the barometer. The wave movement appeared to be from nearly west to nearly east. The building rocked perceptibly, and map frames hanging against the walls were moved onward and backward, making a perceptible noise. The barometric column oscillated noticeably. The duration of the wave movement was about 7 seconds, and there appeared to be about two or three waves to the second. The barometric column stood .012 of an inch higher 8 minutes succeeding the shock than just before. Owing to the height of the building, the office being on the top floor, the wave movement was opposite to what it appeared.

October 1.—Killing frost and ice was observed this morning at 5 a. m.

November 8.—Coldest morning for this season. Minimum temperature, 22.2°. Ice ¼ inch thick on ponds and still waters.

1887.

January 22.—A thunderstorm of considerable intensity occurred this morning. The storm came from the southwest and traveled towards the northwest. The temperature before the storm was 47° and did not change much during its passage. First thunder at 6.28 a. m.; loudest at 6.30 a. m.; and last at 7.10 a. m.

February 8.—Rain all night, and this morning was attended by lightning and thunder. It occurred between 6.18 and 6.22 a. m. The temperature at the time was 54°. Rain ended at 12.30 p. m. Maximum velocity of wind 31 miles, west.

February 17.—A thunderstorm passed over the station between 10 and 11.10 p. m. Sharp flashes of lightning and moderately heavy thunder.

March 12.—A large flock of wild geese observed moving south at 9.45 p. m.

April 2.—The first appearance of bluebirds and robins was noticed this morning.

April 8.—A magnificent lunar corona, consisting of four well defined rings, was observed at 9.45 p. m. The inner ring was of a pale green, the second of a bright yellow, the third of a reddish, and the fourth and outer ring of a pale green color. Diameter of outer ring about 5°.

April 23.—The breaking up of the ice in the Straits of Mackinac opens navigation at Chicago.

May 22.—A thunderstorm which exhibits great energy is moving from west to east north of the station. The oppressive air of a few minutes ago is replaced by decidedly colder air.

July 9.—At 2.30 a. m. a thunderstorm was noticed approaching from the southwest, moving southward. There was much thunder and lightning. Thunder first heard at 3.30 a. m.

July 17.—Extremely hot. Many deaths in city resulting from heat. High southwest to west and northwest winds. A brisk thunderstorm passed over the station between 5 and 6.45 a. m. It apparently developed a few miles southwest of the city and moved from southwest to northeast.

August 10.—Thunderstorm after sunset. 11.10 p. m. rolling thunder was heard northwest. The storm moved from west to east and was attended by heavy rain.

August 18.—Between 6 and 7 p. m. a heavy storm passed over the city from west to east. It was attended by much thunder, lightning, and some hail. The hailstones were not large nor numerous. They were opaque, as large as peas, irregular in shape, flat. The storm probably did not exceed a mile in diameter.

August 31.—The crops in this vicinity have been improved by the recent rains, but are not up to the average, nor is it likely they will be this season.

September 23.—At 6.45 a. m., at the Union Depot, rain was noticed falling when there were no clouds within 10° of the zenith. At 6 p. m. hail was noticed falling with the rain. The hailstones were about the size of peas. They were not numerous.

September 24.—The first frost of the season this morning. Brisk showers during the early morning.

October 12.—The first killing frost of the season occurred this morning. The ground was white, and ice to the thickness of ½ inch formed on water in buckets.

October 23.—The wind blowing a gale of 40 miles. Much damage done to trees, signs, etc.

1888.

January 12.—Rapid and decided changes in pressure and temperature. Barometer fell 0.84 inch in 15 hours. Temperature rose from —4.0° after 7 a. m. to 36.5° at 10 p. m.

January 15.—A severe cold wave accompanied by very high barometer. Height of barometer at 10 p. m., 30.89. Minimum temperature, —14.3°.

January 16.—Barometer (reduced) at 7 a. m., 30.93 inches, the highest observed since opening of station. Continued cold weather in morning, followed during day and evening by rising temperature. Minimum temperature, —16.8°, the coldest since January, 1884.

January 28.—Total eclipse of the moon this day from 2.28 to 8.12 p. m. Clearly visible. A brilliant lunar corona was observed at 6.30 p. m.; the color of the concentric rings being very clearly and distinctly defined. From the inner ring, which was of deep blue, the color faded into almost a pure white at the center of the middle ring. As the outer ring was approached a pinkish tint was observed, deepening to an orange as it neared the center of the outer ring, and finally assuming a deep red hue at the circumference. Diameters: inner ring, about 5°; middle ring, about 8°; outer ring, about 12°. Disappeared at 7 p. m.

February 9.—Coldest day of the season. Minimum temperature, —17.5°.

April 5.—Thunderstorm, with light rain and light southwest winds, passed over station in early morning, moving northwest to southeast. Thunder first heard at 12.15 a. m., and continued during the early morning, with vivid lightning.

April 15.—Thunderstorm in early morning; direction not known; first heard about 2 a. m.; loudest, 5.05 a. m.; last heard at 6.45 a. m. Hail at intervals till 6.45 a. m.; size of hailstones, .02 inch.

April 29.—Temperature fell 46° from 3 p. m. 25th to 7 a. m. 29th.

May 3.—Thunderstorm in early morning; first heard at 12.45 a. m.; loudest at 12.55 a. m., and last heard at 1.10 a. m. Storm moved from west towards east.

May 27.—Heavy thunderstorm in afternoon and evening; loudest at 5.42 p. m. Storm moved from west towards east. Hail from 6.55 to 7 p. m.; size of hailstones, 0.3 inch.

May 28.—Thunderstorm in afternoon; loudest at 2.55 p. m. Storm moved from southwest to northeast. During the storm the barometer rose almost in an instant
29.73, falling again in a few minutes to 29.62.
hunderstorm. As the wind changed to north the temperature fell rapidly,
° at 8 p. m. to 48° at 10 p. m.
nderstorm moving from southwest towards east, and accompanied by
From 11.22 p. m. to 11.45 p. m. .75 inch of rain fell—at the rate of
Thunder first heard at 11.15 p. m., and continued during the night.
p. m. the thermometer fell from 86° to 64° in about 5 minutes,
had been southwest, shifted to northeast.
t day of the season; maximum temperature at 8 p. m., 94°. At

4.55 p. m. a severe thunderstorm arose, accompanied by very heavy rainfall and high north winds. A second thunderstorm, accompanied by vivid lightning, occurred in the morning.

August 2.—A terrific thunderstorm occurred in the late afternoon, accompanied by vivid lightning, excessive rainfall, hail, and high winds. Maximum wind velocity 40 miles, northeast. Thunder loudest at 6.47 p. m. Storm moved from northwest towards southeast. Hail from 6.45 to 6.47 p. m. Size of hail ¼ inch. From 6.27 to 7 p. m. the rainfall was terrific; and it is estimated that 1.50 inch of rain fell in 33 minutes.

September 14.—First frost of the season observed this a. m.

October 2.—Hail from 1.55 to 2 p. m.

October 18.—During the high wind, which occurred about 1 p.m., the barometer suddenly fell from 30.05 to 29.89, rising again to 29.95 in a few minutes. A violent thunderstorm occurred in the evening, accompanied by heavy hail and a magnificent display of lightning. The hailstones varied in size from that of a pea to a walnut, and fell with great rapidity from 6.50 to 7.05 p. m. The lightning flashes were almost continuous from 6.45 to 7.30 p. m., and presented every conceivable form.

November 5.—Thunderstorm in morning and evening.

December 26.—Barometer fell to 29.38 at 3 p. m. High wind continued until after midnight, veering to southwest. The long duration of this gale is almost unprecedented in the history of this station.

1889.

January 1.—Partial eclipse of the sun observed, commencing at 4.21 p. m. The sun disappeared at 5.44 p. m., with but ⅓ of its surface hidden.

January 9.—The barometer had been falling very rapidly during the night, reaching 28.96 inches at 8 a. m. It continued to fall until 12 m., when it read 28.87, the lowest on record at this station.

January 20.—Heavy snow commenced at 12.45 a. m. and ended at 1.50 p. m. Amount of snowfall, 4.5 inches.

March 30.—Hail, accompanied by thunder and lightning, commenced at 7.20 p. m. Size of hailstones very small.

April 15.—Season of navigation now fully open.

May 8.—Continued warm weather, winds fresh to high south-southwest. Maximum velocity 30, southwest.

May 9.—The exceptionally protracted period of high temperature was terminated to-day by a terrific thunderstorm, accompanied by a severe hailstorm and a magnificent display of lightning. At 5.20 p. m. the temperature suddenly fell from 87° to 72°, and at 5.36 p. m. the first thunder was heard and lightning first observed. The rain fell gradual at first, but at 6 p. m. it fell in torrents for a few minutes, changing then to hail, which fell very rapidly, covering the pavements in some places to the depth of ½ inch. Some of the hailstones were over 1 inch in diameter. The shapes of the stones varied, the larger ones being spherical and the smaller ones oval. The barometer fluctuations in the late evening were quite marked, the barometer suddenly rising .08 inch about 9 p. m. and falling again .10 inch by 11 p. m.

July 18.—In the late evening a fierce thunderstorm occurred, accompanied by incessant lightning, high winds, and the heaviest rainfall ever known in the history of the station., 1.60 inch falling from 11.43, July 18, to 12.50 a. m., July 19. From 11.48 to 11.58 p. m. .80 inch fell, or at the rate of 4.80 inches per hour. Thunder first heard at 9.07 p. m.; loudest at 11.26 p. m., and last at 12.45 a. m. Storm moved from northwest towards southeast.

July 27.—Tremendous thunderstorm in evening, accompanied by lightning and heavy southwest winds. About 7 p. m. the temperature fell suddenly from 82° to 67°, and rain fell in perfect torrents from 7.06 p. m. till 10.40 p. m. A trace of rain also f from 6.45 to 6.50 p. m. In all, 4.02 inches of rain fell in 3 hours and 36 minutes.

Large hailstones fell in southern and western portions of the city, although none were observed at the station. This rainfall was the heaviest in the history of the station. From 7.25 to 7.33½ p. m. .40 inch fell, and from 7.44 to 7.49 p. m. .30 inch fell. For one or 2 minutes rain fell at the rate of 6 inches an hour. The damage done by the storm was enormous, amounting to over $1,000,000 in this city. Several lives were lost by falling buildings. Summary of storm as follows:

Thunder first heard at 6.40 p. m.; loudest at 9.08 p. m., and last heard at 10.30 p. m. Storm moved from southwest toward northeast. Direction and temperature before storm, southwest, 84°; after, southwest, 65°. Rain from 6.45 to 6.50 p. m., and from 7.06 to 10.40 p. m. Amount, 4.02 inches.

August 3.—Thunderstorm, accompanied by lightning, in evening. Thunder loudest at 11.04 p. m. Storm moved from northwest toward southwest. In the southern portion of the city the storm was quite heavy, where it is estimated that over one inch of rain fell.

August 31.—This month has been remarkable for the absence of rain, but 0.39 inch having fallen.

September 15.—Warmer in early morning, becoming suddenly cooler about 10.30 a. m., and remaining so; the temperature fell from 74° to 61°.

November 21.—A very remarkable day. About 9.15 a. m. a heavy darkness settled over the city, the streets becoming as dark as they ordinarily are at midnight. The darkness was, no doubt, due to the mingling of particles of vapor and the heavy smoke, caused by the excessive use of soft coal, the wind being so light that it was not able to carry off the smoke. The darkness lasted until 11.45 a. m., or about 2 hours, and during that time outside business was practically interrupted. The entire day continued darker than usual.

November 28.—Very severe gale blowing all day. Maximum velocity 37 miles, west. Much damage on Lake Michigan, numerous vessels disabled. One steam barge ashore a short distance above the city. Severe storm will probably practically end navigation for the season on the Great Lakes.

1890.

January 6.—Station visited in early morning by a very unusual winter phenomenon—a thunderstorm accompanied by lightning. Thunder first heard at 12.22 a. m.; loudest at 12.28 a. m., and last at 12.30 a. m. Storm evidently moved from west toward east. Direction and temperature before storm southwest, 56°; after, northwest, 30°.

January 12.—The temperature reached the exceptionally high point of 62.2°. Barometer fell very rapidly, falling from 30.02 at 8 a. m. to 29.29 at 8 p. m., or .73 inch.

January 22.—Temperature below zero for the first time this winter. Minimum, —5.1°.

February 3.—Lightning observed at 6.45 p. m., and thunder heard in several portions of the city.

February 7.—Snow from 9.28 a. m. to 5.30 p. m. Amount of snowfall, 5.3 inches.

March 25.—Winds, high westerly, reaching an extreme velocity of 80 miles at 10.54 a. m.

March 27.—Thunder in evening, accompanied by lightning.

A[illegible]—Thunderstorm, accompanied by lightning, in early evening.

[illegible]—Moon dogs were observed at 9 p. m. The moon at that time was about [illegible]e horizon. A bright streak of light extended about 5° on each side of the [illegible] at right angles to the horizon. On a line parallel to the horizon were two [illegible] on either side of the moon. These spots were small and highly colored, [illegible] of the prismatic colors being distinctly visible, the brightest of which were [illegible]nd green. The spots lasted about an hour, but the streak of light was still to be [illegible]t midnight, although at that time it was rather indistinct.

[illegible]*pril* 7.—In late evening a thunderstorm, accompanied by lightning, occurred.

[illegible]*pril* 8.—Temperature fell from 68° to 45° from noon to 8 p. m. Thunderstorm in early morning. Shortly before 5 a. m. the barometer fell almost suddenly .17 inch, then rose .10 inch, fell .09 inch, then rose .05 inch by 6 a. m. The sudden and severe oscillations caused a succession of small tidal waves on Lake Michigan, at intervals of about 10 minutes, from 5 a. m. to 11 a. m. The water from the lake rushed into the Chicago River and tore several vessels from their moorings. The damage was comparatively slight.

April 13.—Thunderstorm in afternoon and evening, accompanied by lightning and high northeast wind. Thunder first heard 5.5 p. m., loudest at 5.56 p. m., and last at 9.15 p. m. Storm moved from the west towards the east.

April 23.—About 6 p. m. the temperature fell suddenly about 15° (from 70° to 55°) and the wind changed to northeast.

April 30.—At 6 p. m. temperature fell suddenly about 15°, and continued to fall, reaching 43° above at about 8 p. m. Winds high southwest shifting to northeast at 5.40 p. m.

May 3.—Temperature continued to rise until 12.30 p. m., when it fell suddenly about 25° in the next half hour. Winds fresh southwesterly, veering to the northwest at about midnight; thunderstorm occurred in afternoon. Storm moved from the west towards the northeast.

May 9.—Late in afternoon the wind backed to northeast and the temperature suddenly fell 15°. Thunderstorm in evening.

May 12.—Thunderstorm, accompanied by lightning, in morning. Storm moved from northwest toward southeast. Towards evening the wind shifted from south to northeast, and the temperature fell, almost suddenly, from 64° to 48°.

May 22.—Thunderstorm in the evening, a great display of lightning was seen during the entire storm, in the southeast and south. The storm moved from the west towards the east. Winds northerly, shifting to southerly.

May 24.—Thunderstorm in the afternoon, accompanied by vivid lightning. Storm moved from west towards the east. Hail from 1.20 to 1.27 p. m. Hailstones as large as robin's eggs fell. Amount of rainfall, .73. The temperature fell about 13° during the storm, and then rose again to the normal.

June 3.—Thunderstorm, with lightning, in early morning.

June 11.—Thunderstorm, accompanied by vivid lightning of every description, in evening. Storm moved from west toward northeast.

June 13.—Thunderstorm commenced at 1.58 p. m., and was of a very extensive character. For an hour its approach was watched. About the time rain commenced the rain front was estimated to be at least 40 miles long, with much lightning to the south. Its movement was east by south. Thunder loudest at 2.48 p. m. Direction from which storm moved, southwest to northeast. Direction of wind and temperature before, east, 67°; after, east, 64°.

June 27.—Brisk and rather severe thunderstorm occurred, the temperature fell from 86° at 2.45 p. m. to 69° at 4 p. m., and the wind shifted suddenly from south to northeast. After the storm, which was accompanied by zigzag lightning, and moved east across the lake, the temperature rose rapidly, reaching 89° a few minutes after 6 p. m. Direction from which storm moved, northwest toward southeast.

June 29.—Thunderstorm in the afternoon, accompanied by lightning.

July 3.—Thunderstorm in the afternoon. Heavy rain fell after the thunderstorm had ceased; .25 inch falling in 5½ minutes, from 7.03 to 7.08½ p. m.

July 9.—Cooler. High winds; maximum velocity 38, northeast.

July 12.—Thunderstorm in late morning.

July 14.—The temperature reached 90° shortly before 1 p. m., at this time the wind shifted suddenly from southeast to northeast, and increased to a velocity of 36 miles per hour. Within 15 minutes the temperature had fallen from 90° to 68°, and a very severe thunderstorm passed about 2 miles east of the station, moving from north to southeast. The rain area appeared to have a direct easterly motion, and heavy rain could be seen falling a short distance out on Lake Michigan. At 4 p. m. thunder was again hear and along the horizon there appeared a line of the darkest purple. The rain fell in torrents and the wind reached a velocity of 48 miles per hour. The rainfall was excessive, one inch falling from 5.13 to 5.47 p. m. From 5.31 to 5.34 p. m. .25 inch fell, or at the rate of 7 inches per hour. Direction from which storm moved, northeast towards south.

August 3.—Continued warm weather until nearly 4 p. m., when a thunderstorm arose, and the temperature fell from 95° to 75°, wind shifted from south to northwest and then northeast; becoming fresh.

October 12.—Thunderstorm in afternoon. Storm moved from north towards southeast.

October 13.—Considerable damage done on the lake to shipping by the high wind. A gale blew from the southwest after 8 a. m. Maximum velocity 50 miles per hour, southwest.

October 27.—Killing frost in a. m.

November 8.—Dense fog after 8 p. m. The barometer fell rapidly after 11 a. m. and the wind gradually increased in force, until it reached a velocity of 44 miles, southeast.

December 4.—Snow commenced at 5.30 p. m. and continued. Amount of fall to midnight, 3.5 inches.

1891.

January 1.—Shortly before 1 p. m. the wind, which had been southerly, backed to northeast, and the temperature commenced to fall rapidly.

February 19.—Snow commenced at 5.45 p. m., changing to hail at 6.30 p. m., and again to rain at 8.50 p. m. The fall of hail was very heavy, at least 2 inches having fallen. The storm was accompanied by a high wind and frequent and decided barometric oscillations, the alternate rises and falls in several cases amounting to 0.10 inch in a very short space of time.

February 24.—Thunderstorm in late afternoon and early evening, accompanied by lightning and high wind. Storm moved from southwest towards northeast. Maximum velocity 60 miles, southwest.

March 30.—Thunderstorm occurred just after noon. Storm moved from west towards east.

April 17.—Heavy thunderstorm, with lightning, occurred in evening. Storm moved from west towards east.

April 21.—Heavy thunderstorm, with lightning, in afternoon and evening. Storm moved from west towards east.

May 15.—Warmer until 4.45 p. m., when wind shifted from west to north and became high, and temperature commenced to fall rapidly; from 4.45 to 6 p. m. it fell from 77° to 49°.

May 20.—Thunder and lightning in early evening. Storm moved from west towards east.

May 21.—Thunderstorm in afternoon. Temperature stationary until afternoon, when wind shifted from southwest to northwest, with a fall in temperature of about 21°.

June 1.—Thunderstorm, with lightning, in late afternoon. Heavy rain, with hail, in southern portion of city. Storm moved from southeast towards northwest. Second thunderstorm, with vivid lightning, in late evening. Storm moved from north towards east.

June 3.—Wind shifted from southwest to northeast, increasing in force, and temperature fell suddenly from 83° to 62°. Thunderstorm commenced shortly after. In the interval between the rain the temperature rose slightly and the wind shifted to southeast, but at 10.30 p. m. the wind backed to northeast and the temperature again fell suddenly from 63° to 48°. Thunderstorm moved from northwest towards east.

June 16.—Little warmer during the day until 5 p. m., when, with northeast wind, the temperature fell about 15°—to 72°. Thunder and lightning shortly after midnight. Thunderstorm in the evening, with lightning. Storm moved from west towards east.

July 17.—Little change in temperature until late afternoon, when wind shifted to west and northwest, and temperature fell about 12°.

August 9.—Maximum temperature, 96.1°. 4 p. m. wind shifted to northeast, and temperature fell suddenly from 96° to 74°. Thunderstorm, accompanied by lightning, followed shortly after. Storm moved from northwest towards east. Direction of wind and temperature before storm, southwest, 92°; after, west, 74°.

August 19.—Thunderstorm, with lightning, in late afternoon. Storm moved from southwest towards northeast. A peculiarity of the storm was, that it was decidedly local, no rain falling 4 miles from this office.

September 14.—Thunderstorm in evening, with lightning. Storm moved from northwest toward southeast.

September 20.—Cloudless and very warm. The long duration of the present warm period is unprecedented for September, the mean temperature for the past 5 days being above 75°. Brisk to high southwest winds.

September 24.—Continued warm and cloudless. Warmest day of month. Maximum temperature 90.8°, being only the sixth day in September for 21 years in which the maximum temperature exceeded 90°.

September 27.—Warmer and generally cloudless. Southerly winds.

September 28.—Temperature a little lower during the day until about 7.30 p. m., when wind shifted to northwest, and temperature fell rapidly from 74° to 56°. A light thunderstorm, with rain and lightning, occurred about the same time. Storm moved from northwest to southeast.

September 30.—First light frost of the season this morning.

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